metal finishing

APPLICATION, ELECTRODEPOSITION, VITREOUS ENAMELLING, GALVANIZING, METAL SPRAYING and all METAL FINISHING PROCESSES

Vol. 4 No. 40 (new series) APRIL, 1958

Mr. Therm include Architects, Builders, Engineers, Hospital workers, Educationists, Ceramists, Confectioners, Caterers
Bruce Langhorne

THERM - QUICK CHANGE ARTIST No 1

MR. THERM'S LIBRARY LIST

UNIVERSITY OF MICHIGAN
MAR 1958
ENGINEERING LIBRARY

1 .....

2 .....

3 .....

4 .....

5 .....

6 .....

GAS...
Always and in ALL WAYS working for YOU!

Issued by the Gas Council

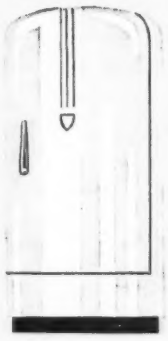
Frits!

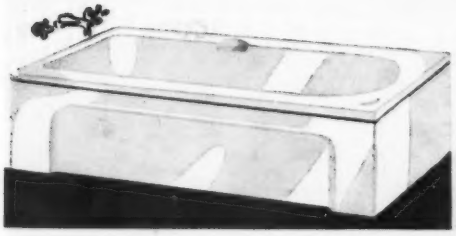
AND ENAMELS TOO

Blythe Colour Works are renowned, not only for their unequalled range of Frits for cast and sheet iron, but for their all-important after-sales service ensuring your absolute satisfaction.

Transparent or opaque enamels too, for application by wet or dry process, and concentrated oxides to give that vital spark of colour.

Blythe's exceptional facilities and recognised ability, coupled with specialised manufacturing technique, are always available to solve your particular colour problems; and remember—a Blythe technician is always at your service.





BLYTHE COLOUR WORKS LTD.
CRESSWELL · STOKE-ON-TRENT · ENGLAND
Telephone BLYTHE BRIDGE 2101

Blythe

home of the world's best colours

metal finishing Journal

April, 1958 — Vol. 4, No. 40 (New Series)

AN INDUSTRIAL NEWSPAPERS PUBLICATION

Editor : JOHN HOOPER *Assistant Editor :* E. H. LLOYD, A.I.M., A.C.T.(Birm.) *News Editor :* L. J. BACON

Southern Area Manager : E. COLLIS *Northern Area Manager :* G. P. ELLIOTT *Scottish Area Manager :* T. H. SMITH

Western Area Manager : E. J. SWEETING *Eastern Area Manager :* ERIC PERRIN

Production Manager : R. J. LOVELL *Circulation Manager :* E. T. GRIFFITHS *Publisher :* H. J. DWYER

Official Organ of the

INSTITUTE OF VITREOUS ENAMELLERS

President :
C. R. WHEELER, C.B.E.

Chairman :
J. H. GRAY

Secretary :
J. D. GARDOM
John Gardom & Co., Ripley, Derby
Telephone : Ripley 136

Published on the 15th day of each month by

INDUSTRIAL NEWSPAPERS LIMITED

Chairman and Joint Managing Director
Barrington Hooper, C.B.E.
Joint Managing Director and Commercial Director :
F. Barrington Hooper, B.A.
Director :
F. R. Lewis
Director and Secretary :
E. G. Weston

JOHN ADAM HOUSE
17-19 JOHN ADAM STREET
ADELPHI, LONDON, W.C.2
Telephone : TRAfalgar 6171 (P.B.X.)
Telegrams : Zacatecas, Rand, London

Subscription Terms :
Home and Overseas 24*s.* per annum prepayable
Single copies 2*s.* (2*s.* 4*d.* *post free*)

THIS JOURNAL IS DEVOTED TO THE SCIENCE AND TECHNOLOGY OF PAINT APPLICATION, ELECTRODEPOSITION, VITREOUS ENAMELLING, GALVANIZING, ANODIZING, METAL SPRAYING & ALL METAL FINISHING PROCESSES. THE EDITOR IS PREPARED TO CONSIDER FOR PUBLICATION ANY ARTICLE COMING WITHIN THE PURVIEW OF "METAL FINISHING JOURNAL" AND ALL SUCH ARTICLES ACCEPTED WILL BE PAID FOR AT THE USUAL RATES.

Contents

PAGE

Form and Finish **117**

Talking Points **118**
" Platelayer "

The Value of Specifications in Decorative Nickel Plating **119**
H. C. Castell

Overseas Review **122**
" Scrutator "

The Assessment of Heating Requirements for Metal Finishing Process Tanks **123**
H. C. Hickman, B.Sc. (Eng) (Hons), A.M.I.Mech.E., Grad. I.E.E.

New Refrigerator Painting Line features Flow-Coat Priming and Electrostatic Finishing **127**

Finishing Post **130**

Oil and Colour Chemists Exhibition **132**

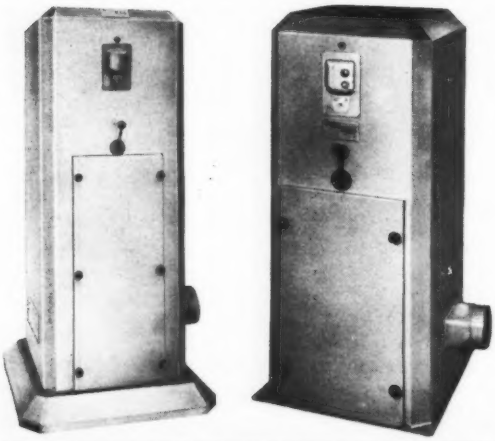
Finishing News Review **139**

Plant, Processes and Equipment **147**

PROCESSING TANKS

Tanks of all sizes and types for industrial processes and for storage. Tanks made of mild steel, stainless steel, heated and insulated, galvanised, metal sprayed, lined with rubber, lead or P.V.C. We also fabricate Tanks from glass fibre (as illustrated) with various resin combinations for special requirements.

Write for brochure R.P./1



DUST COLLECTING

Illustrating our popular unit dust collectors, with capacities of 200/1400 and 180/770 cubic feet of air per minute, according to resistance conditions. Our intensive research into the control of many forms of industrial dust has enabled us to design and manufacture large and small installations suitable for a wide variety of industries.

Write for brochure D/1

INDUSTRIAL OVENS

For a better finish to your products you need a Griffiths Oven. Our Box Ovens, for tray, trolley or suspension loading, and Conveyor Ovens, for a continuous processing operation, will give you maximum efficiency with economy in labour and fuel.

Write for brochure M.F.O./1.

A. E. GRIFFITHS (SMETHWICK) LTD.
BOOTH STREET, BIRMINGHAM 21

ORM AND FINISH

THE procedures and processes used in the manufacture of components and commodities are many and varied, and their number is being added to almost from day to day as new techniques are developed and evolved by scientists and technologists. It was to discuss the broad field of methods of engineering manufacture that some 700 delegates assembled in Church House recently at a three-day conference organized under the auspices of the Institution of Mechanical Engineers under the general thematic heading of "The Technology of Engineering Manufacture." At this Conference an attempt was made to present and discuss some 50 papers contributed by many acknowledged experts and authorities. This was certainly an ambitious and perhaps optimistic enterprise, and it was inevitable that even with such an impressive array of papers and with the assistance of many learned contributions to the discussion, some vital subjects should only be referred to in passing and others ignored completely. It is doubtful whether adequate coverage of the field implied by the title could be obtained in double the number of papers, discussed at four times the length.

Nevertheless within these obvious and acknowledged limits the Conference can be adjudged to have fulfilled a very useful function — indeed it would be remarkable if an assemblage of such a galaxy of engineering talent for whatsoever purpose could fail to produce some worthwhile comment. What was perhaps one of the more significant features of the Conference as far as we are concerned was the failure to recognize that metal finishing is as vital an aspect of manufacturing technology as are all the various processes for achieving the desired metallic shape.

A number of particularly effective pleas was made for a greater degree of enlightenment in the drawing office with regard to the potentialities and limitations of engineering processes. The evolution of new materials and new methods of manufacture have made possible a revolution in the design of many articles and components, and yet a very great deal of engineering design still follows the stereotyped pattern established when the choice was considerably more limited.

If this is true of metal-forming processes it is no less true of finishing processes, and much of the cost and failure in service of present-day finishes could be avoided if as much attention were devoted to the selection of the finish, and the adoption of a design to suit that finish, as is given to the engineering aspects of design and materials. The very use of the word finish implies that without this final process the article is unfinished, but the complete integration of finishing into the technology of manufacture is still very slow to come about. All too often the finishing process is applied almost as an afterthought and the attitude appears to be that a "lick of paint" will serve to cover up some of the minor surface defects incurred during manufacture and will help to delay the onset of corrosion until the article is out of the factory and with luck, out of the retailer's shop as well.

In a very great number of cases however, the two factors which have the greatest point-of-sale influence are design (in respect of suitability for function) and appearance or eye appeal, i.e. finish. The question of whether the most suitable material of construction has been chosen or whether investment casting would have been a more suitable manufacturing process than machining is seldom one that exercises the mind of the average lay purchaser.

Proper attention to metal finishing of all the production processes can be the most rewarding in respect of sales and on this ground alone it is deserving of very much more serious consideration.

Talking Points

by "PLATELAYER"

TOPICAL COMMENT FROM THE MAIN LINES AND SIDE LINES OF METAL FINISHING

CARBOYS

TO the plastics industry the very existence of carboys must be an exasperating challenge. For despite the plethora of new corrosion-resisting materials, the commonest means of transporting acids and corrosive chemicals general is still the glass carboy, as it has been for over a century. Even the origin of the words is of great antiquity, coming as it does from the Persian "qaraba," a large flagon.

The carboy is fragile, and must be encased in a basket packed with straw, which makes matters worse by constituting a fire hazard. The most likely challenger in the field will probably be the polythene bottle, either free standing or encased in a steel drum. Such containers are, however, more expensive than carboys, although they take up less space and so save transport costs. They are gradually coming into use, although it has been found that recipients are slower to return them than carboys when empty. This means that larger stocks of containers must be carried, which is clearly undesirable. The very awkwardness of the carboy is thus in its favour, as everybody wants to be rid of an empty carboy as soon as possible.

Polythene has, however, invaded the glass carboy itself; many carboys are now fitted with polythene stoppers, although one hears that these are not always trouble-free.

That glass, the oldest "plastic" is by no means a back number in other directions, too, is shown by the steadily increasing use of glass apparatus for industry. Only recently a British technical college has installed a complete drainage system of glass, including traps. No less than a mile of borosilicate glass pipe line was used, and the combination of transparency, ease of cleaning and high chemical and heat resistance of glass could not be achieved in any other way.

USES OF ADVERSITY

IN the Melchett Lecture last month, the speaker referred to the advances in the civil applications of atomic energy which this country has made in the past 10 years, and the fact that we are now probably 3 years ahead of the Americans in the field. Soon after Britain started development, the Mahon Act was passed in the U.S.A. which effectively cut us off from practically all American atomic research information so that we had to proceed on our own initiative.

There is a moral in this. Looking at someone else's plant or studying his processes does often result in a tendency to develop in his footsteps. By the time your own production has got going, which may well take two years or more, the original procedures on which your designs are based are probably out of date. Original thinking on independent lines with no precedent to work on can therefore often result in a really major advance.

The only snag in this approach is that independent development is likely to be a lot more expensive; this matters rather less to Governments than to ordinary people.

WONDER MACHINE

A VERY curious gadget, which has been sold to industry on a small scale for many years, is a magnetic device which is claimed to prevent the building up of scale in boilers. The boiler feed water is passed through the unit, and it is said that the scale which then forms in the boiler is non-adherent and can simply be hosed away. Some years ago the system was the subject of an official report which indicated that there was no theoretical basis upon which it could be recommended, but hesitated to condemn it outright. I believe units of this kind are still being marketed in this country and some people are enthusiastic about them.

It is therefore with interest that I read that a modernized version of a similar device has entered the phosphating field in the U.S.A. The Packard Water Conditioner as it is called, when fitted into the main water supply line to a phosphating plant, prevents all scaling of steam coils used in such tanks, thereby eliminating the thoroughly unpleasant job of regularly chiseling scale off them.

To the technically-minded, the following makers' description of how the thing works may be of interest:

"In principle, the Packard Water Conditioner passes the water through a mechanical force field created by Alnico permanent magnets. In theory, the molecules of scale-forming substances receive a superficial tension due to electrical bombardment. This tension prevents the scale formation of carbonates, sulphates or silicates with waters of crystallization."

I cannot understand a word of it, but the makers apparently give a money-back guarantee with the apparatus; therefore it must work or they would soon be bankrupt.

The Value of SPECIFICATIONS in Decorative Nickel Plating

by H. C. CASTELL*

Introduction

As a means of providing a protective and bright undercoat to chromium on articles which are fabricated from the baser constructional metals, electrodeposited nickel, without doubt, stands alone. In no other way is it possible, at low cost, to give a permanent white and bright metallic finish to articles made from a variety of metals which themselves would corrode under normal atmospheric conditions. This feature of nickel and chromium plating is understood and tacitly accepted by the general public, since there are a multitude of articles in everyday use which traditionally are "chromium plated" and recognised as such by their bright and shiny appearance. In some fields where nickel and chromium plating is used, however, there have been instances where the performance of the plated article has not, unfortunately, been entirely satisfactory. Why is this so? Why do some articles keep their bright appearance indefinitely, whereas others, used under different conditions, show unsightly corrosion after a relatively short period of service?

The answer, of course, is to be found in the type of environment in which the article is used. Metals exposed to wet atmospheric conditions out of doors are more liable to corrosion than those which are used indoors, normally in a warm and dry atmosphere. This is true also of nickel, but fortunately, in the plating process, steps can be taken to provide, for outdoor service, a surface which is just as corrosion-protective as those which are used indoors.

Porosity or Corrosion?

In the past, and to some extent even today, it was believed that an electroplated metal was porous, that a discontinuous deposit was one of the inherent drawbacks of the process, and that it was necessary to seal the holes by plating sufficiently thick deposits or by buffing the deposit. Even today these ideas persist to some extent and a great deal of effort has been expended in devising tests to show the degree of porosity present in a newly made deposit. One of the difficulties with these so-called porosity tests was that it has not been found possible to relate the number of pores which they reveal with the extent of the breakdown sometimes observed in service.

Furthermore, many investigators have spent much time making microscopic examinations of nickel deposits in the hope of identifying fissures and holes in the deposits, but such investigations have been singularly unsuccessful. It has not been possible to find pores present in sufficient numbers to explain the multitude of corrosion spots which are sometimes seen.

Discontinuities in deposits can be caused as the result of co-deposited insoluble particles originally suspended in the plating solution, or by gas bubbles that cling to the article during plating, locally preventing deposition and leaving a pit or cavity large enough to allow corrosion agents subsequently to attack the basis metal. Cracks in the deposit can also cause failure in the same way. The plater can, however, take steps to prevent the occurrence of these defects.

It was, therefore, necessary to look elsewhere for an explanation of the breakdown of nickel electrodeposits, since it had become apparent that the plating process was indeed capable of producing sound deposits. Moreover, as time went by, improved filtration techniques were introduced, platers became more aware of the need for purifying their solutions from contaminating metals, and closer chemical and physical controls were exercised. All this undoubtedly effected improvements in the general quality of the deposits but, in spite of this, complaints of rapid deterioration by corrosion of plated articles were still sometimes reported.

Recent work, both in the U.S.A. and in this country, has established that the true cause of breakdown is corrosion of the nickel deposit itself. An initially sound deposit may, after a short period of service, show a pitting type of corrosion, beginning as a shallow spherical pit and gradually deepening as the time of exposure increases, until finally the basis metal is exposed.

*The Mond Nickel Co. Ltd

It is not necessary here to give a detailed description of how such corrosion starts except, perhaps, to say that there are a few main factors which give rise to it. The chromium top coat is very thin and often cracked and discontinuities in this outer layer can cause electrochemical attack on the nickel. The large cathodic areas of the chromium promote attack on the nickel at the much smaller anodic areas exposed at the base of a crack or pore. Corrosive agents in the atmosphere, such as sulphur gases, particularly in industrial centres, are very damaging to nickel. Corrosive attack is well known in other fields. In such cases differential oxygen concentration gives rise to galvanic effects, or dusts, particularly soot particles, can lie undisturbed for long periods. Such forms of corrosive attack are equally applicable in the case of electrodeposited coatings. Finally, and, perhaps, most important of all, thin deposits allow penetration by corrosion to take place in a relatively short time.

Factors Contributing to Breakdown

Although pitting corrosion of the nickel deposit certainly does occur, the rate of penetration is slow and, once started, it need not necessarily continue. Thorough and regular cleaning of the article during service can delay the progress of corrosion and can prevent the occurrence of new centres. The shallow pits may also be filled with impermeable corrosion products or polishing waxes. On the other hand, once penetration through to the basis metal has occurred and the nickel/basis-metal corrosion cell has been set up, the permeable nature of the corrosion product makes it impossible, by any treatment, to stop the spread of corrosion and the disfigurement of the article by the continual appearance of unsightly corrosion product. Furthermore, a corrosion pit in the nickel deposit spreads laterally as well as in depth, and the rate at which corrosion proceeds through the deposit diminishes as the pit enlarges and the amount of corrosion product increases. Increasing the thickness of the nickel deposit, therefore, will give more than a proportionate increase in the time of penetration to the basis metal : in other words, doubling the thickness of the deposit gives much more than twice the serviceable life, all other things being equal.

The factors contributing directly to the early breakdown of nickel plated articles, are, therefore :—

1. Ready-made pores and discontinuities, arising from co-deposition of insoluble particles suspended in solution.
2. Gas-bubble pitting.
3. Cracks in the deposit.
4. Penetration of the deposit by corrosion.

Factors 1 and 2 have been practically eliminated in present-day plating techniques, by improved methods and faster rates of filtration, by careful agitation of the solution around the cathodes or the use, in some proprietary solutions, of wetting agents and, further, by visual inspection before the finished article leaves the plater's works.

Cracks occur in nickel deposits as a result of a combination of high internal tensile stress and low ductility. This, in turn, is due to excessive contamination of the plating solution by metallic or organic impurities. It is now known that ordinary nickel-plating solutions of the Watts type, on which all modern bright-nickel solutions are based, give deposits in which moderately high tensile stresses are present. Most organic-containing solutions contain addition agents which reduce the stress, even causing it in some cases to become compressive. In course of working, however, these solutions become contaminated with organic breakdown products which cause reduction in ductility of the deposit. This change in the mechanical properties is often a slow process ; it sometimes takes many months for the ductility to reach a danger level. Platers know that, before this level is reached, purification of the solution with activated carbon is necessary and some even apply a continuous purification by packing their filters with carbon. With regular carbon purification and judicious use of anti-stress agents the danger of cracked deposits is, therefore, now no longer real, as it was in the early days of the operation of organic-containing bright solutions.

Considering now the last likely cause of failure, that of penetration of the deposit by corrosion, it has been shown that the time for penetration is largely a function of the thickness of the deposit, the type of corroding agent which is at work, and the shape or pattern of the article which, in turn, determines the ease with which the article can be plated with a uniform thickness of deposit and how thoroughly the plated surface can be cleaned in service.

In 1947 one of the sub-committees of the American Society for Testing Materials drew up an extensive programme of atmospheric tests on steel panels plated with " decorative grade " coatings. In the original programme thirty-four different systems of plating, all concerned either with nickel and chromium or with copper, nickel and chromium deposits, were exposed to five different atmospheres in the U.S.A., ranging from mild rural to heavy industrial types and including exposure to marine conditions. After just over 3½ years the committee reported on the behaviour of the exposed panels, and the main conclusion was that the thickness of the nickel layer, applied directly to the steel or to a copper undercoat, is the factor which principally determines the length of life. Other conclusions were concerned with the effects of copper undercoats (important only in the early stages of deterioration or in mildly corrosive atmospheres)

and the effects of the various forms in which the nickel deposit was applied (marked improvements, in marine atmospheres only, if the nickel be applied in two layers).

Uniform and Greater Deposit Thicknesses

When, therefore, a plater is asked to provide a decorative nickel/chromium finish to an article fabricated in a baser metal, his first consideration must be the sort of environment in which the article is likely to be used, and the thickness of deposit necessary to ensure freedom from visible deterioration for a long period of time. In many cases the actual manufacturer of the article will specify the type and thicknesses of the deposit, having in mind the conditions in which it will be used. Otherwise, the plater may be guided by the British Standard Specification (B.S. 1224:1953).

Unfortunately, in some respects, this specification was drawn up for only three conditions of use ; severe, moderate and light duty, pertaining principally to plated articles on motor cars. Indeed, in the actual document, there is no attempt to describe the appropriate uses for the three qualities of coating recommended, and it is possible for a plater to deposit the thinnest nickel layer recommended and yet to describe the article as having been plated to BS. 1224. It is therefore necessary for such a specification to give some clearer guidance on adequate thicknesses of deposit for specific purposes.

In specifying thicknesses of plated deposits, it is the custom to give a minimum value which can be measured at any point over the whole of the plated surface visible when the article is in service. Throwing power effects may, however, result sometimes in considerable non-uniformity of deposit thicknesses over the surface of an article. Thus, thin deposits will be found on those parts of surfaces which are recessed, or on the central regions of large flat areas, with correspondingly thicker deposits on corners, edges or protuberances. A specified thickness must take into account this limitation and, if the whole surface is to remain in its original condition for a reasonable time, it is necessary to specify the thinnest deposit which is acceptable for the service that the article is to perform. Much can be done by the plater to ensure that the article, during the plating process, receives the most uniform deposit possible. The article should be racked in a special way and, where possible, anodes should be shaped or grouped to conform with the contour of the article, while "robbers," or insulators, can be used to reduce build-up of the deposit on protuberances. Planned racking is also necessary, so that individual components on a rack help one another in spreading the nickel to the best advantage.

Many platers find it convenient to suspend the articles in the solution by means of copper wire, either attached directly to the cathode rod or to conducting frames which themselves are hooked to the cathode rod. Owing to the complexity of the shape of some articles and to the fact that the number to be plated may be small, the expense involved in constructing special racks is sometimes not justified. It must, nevertheless, be borne in mind that the use of racks in large production runs offers three important advantages :

(1) The article is held firmly in the solution and, because of this, the electrical contact is sound.

(2) The rack can be so designed that the article is rigidly positioned with respect to the anode, and significant surfaces receive the appropriate thickness of deposit.

(3) Parts of the rack under the solution can be insulated by covering with stop-off tape or lacquer. In this way no nickel is wasted by deposition on to the surfaces of the electrical conductors. When copper wire is used, the area of the wire surfaces, and hence the weight of nickel deposited there, is often a significant proportion of that deposited on the article.

After due consideration of all the points previously discussed, the following specification is proposed. Particular attention has mainly been given to type of service and the minimum thickness of nickel deposit appropriate to that service. In the case of zinc-base die castings, the copper undercoat is regarded purely as a means of preventing attack by the acid nickel solution on the zinc alloy, and as a means of preventing immersion deposits of nickel, not as a substitute for part of the nickel deposit when it acts as a corrosion preventive layer.

Basis Metal	Service	Minimum Thickness of Nickel Deposit
		inch
Steel	Severe exterior service (e.g., parts of a car which might be attacked by road salt and exhaust fumes)	0.002-0.003
Steel	General exterior and severe internal service (e.g., external parts on cars, kitchen and bathroom ware)	0.001-0.0015
Steel	Interior service where warm, dry atmospheres are normally obtained	0.0005-0.001
Brass	Exterior service or severe interior service	0.0005-0.0007
Brass	Interior service with warm and dry atmospheres	0.0003-0.0005
Zinc-base die castings	Exterior service or severe interior service	0.001-0.0015 (with 0.0003 copper undercoat)
Zinc-base die castings	Interior service with warm and dry atmospheres	0.0005-0.0007 (with 0.0003 copper undercoat)

A Quarterly Survey of some of the Features in Finishing Literature from Abroad

by **SCRUTATOR**

IN spite of the vast amount of painting and other types of finishing carried out by railway companies, finishing journals in general contain comparatively few articles dealing with this subject. A recent account of the finishing facilities of the American "N and W" (Norfolk and Western) Railway[1] is therefore of considerable interest and particularly so because a rather novel type of paint spray booth is described. Paint is applied by steam spraying in a brick building shaped like a tunnel, through the centre of which runs a track on which the railroad cars can be moved in and out. A U-shaped travelling double spray booth (with the U upside down) and overhead exhaust ducting moves along tracks parallel to the railway lines so that there is in effect a booth on either side of the car. One painter in each booth on a platform which can be raised or lowered can thus adequately paint all significant surfaces with the minimum of effort and cost.

Plating and Stripping

Although much has been written about the plating of aluminium and many methods have been advocated for doing this, according to Withers and Ritt[2] there has not, up to now, been any simple reliable procedure. Their technique consists of degreasing, etching for 10-15 seconds in 10 per cent v/v hydrofluoric acid, rinsing, etching again for 10-80 seconds in 50 per cent hydrochloric acid containing 9-10 gm. per litre manganese sulphate, rinsing and nickel plating in a sulphate solution containing ammonium chloride, boric acid and 10 oz. per gal. magnesium sulphate. 0.0001-0.0005 in. nickel is deposited and after heating for 5 minutes at 800-1050°F., the cooled surfaces are cleaned in 25 per cent sulphuric acid, rinsed and are then ready for the electrodeposition of any desired metal. Excellent results are claimed.

So much for putting metal on. As regards getting it off, Houdaille Industries, Huntingdon, West Virginia[3] claim that since they changed to a dry acid replacement salt for stripping the chromium from reject automobile bumpers, there has been a 50 per cent reduction in the labour costs for stripping and re-plating. This proprietary powder, which is used at a concentration of ¾ lb. per gallon of water and a temperature of 200-205° F., is claimed to leave the nickel undercoat free of etch, smut and oxide discolouration and to activate the nickel so that after stripping, the parts are ready for re-chroming after water rinsing.

Treatments for Copper and Magnesium

Margulies[4] has described some most encouraging results from the production use of a 10-60 seconds dip in 25 per cent ammonium-persulphate solution at room temperature for the removal of stains and oxide films etc. from brass and copper. In addition to the obvious advantages of such low temperature treatment as compared with the hot pickle previously employed, the process is claimed to provide a tarnish proof (temporary) surface suitable for subsequent painting, electroplating or dip-soldering. Slight agitation of the parts during treatment is recommended and one gallon of solution will treat about 100 square feet.

Although the HAE process was first introduced as long ago as 1951, it is claimed that it still holds the field among other newly developed anodic treatments as a superior coating for the protection of magnesium alloys. Details of the process and characteristics of the coatings together with the new improvements and modifications developed during the last three years have recently been summarized and published[5]. Coating formation takes place in two phases. The first produces a smooth, tan-coloured coating in about five minutes at room temperature which is an excellent base for paint, resins or other organic finishes. The second phase produces a hard, highly abrasion resistant brown coloured coating with good corrosion and heat resistant characteristics. The solution, which consists of potassium-hydroxide-aluminate-fluoride-manganate and sodium phosphate, can, however, now also be employed to produce an olive-drab coating on aluminium-bearing magnesium alloys. As with the original process, alternating current is employed, but a treatment time of 20-25 minutes is required at 132-140°F. The current density is about 40 amp. per square foot with an applied voltage of 9 volts and post-treatment consists of immersion for 2-3 minutes in 0.3 per cent sodium dichromate at 185-195¾F.

(*Continued in page* 150)

THE ASSESSMENT OF HEATING REQUIREMENTS

for Metal Finishing Process Tanks

by H. C. HICKMAN, B.Sc (Eng.)(Hons.), A.M.I. Mech.E., Grad. I.E.E.*

WITH the advent of large scale automatic plant for electro-plating and chemical cleaning processes, it has become necessary to devote more attention to the problems of assessing and supplying the heat requirements of the associated process tanks. It is no longer feasible, for economic reasons, to provide for a more than adequate margin to these requirements and accordingly the various governing factors must be carefully analysed.

The problem resolves itself into two distinct aspects :—

1. To raise the temperature of the bath to its working level within a reasonable time.
2. To maintain that temperature during processing.

In general the first consideration is much easier to assess and will usually require the greater load, whilst the second may even necessitate heat removal.

Heating up the Solution

To determine the amount of heat required to raise the temperature of a solution, the product of mass, specific heat and rise in temperature ($ms\theta$) must be determined and an allowance made for the losses to atmosphere, which can usually be expressed with sufficient accuracy as a percentage of the above product. The actual figure taken will depend on the final temperature, the time of heating and the shape of the tank, and will be based on previous experience.

In the absence of previous experience the following analytical treatment may be employed. It is known that, neglecting evaporation, the heat loss to the surroundings from a hot body is proportional to the difference in temperature of the body and surroundings. This is not strictly true for large temperature differences but within the range considered (up to 140°F.) it is sufficiently accurate for the purpose.

Thus the total heat loss over a time T hours will be given by

$$Q = \int_0^T K_1\theta dt \quad \ldots\ldots\ldots 1.$$

where K_1 is a constant expressed in the units of BTU per hr. per °F. and θ the temperature rise above ambient.

The temperature will vary with time in a manner indicated in the diagram and the relationship can be determined from the following consideration.

Rate of heat input = Rate of heat storage + Rate of heat wastage.

The case of electrical heating where the rate of heat input is constant at A BTU per hr. gives

$$Adt = Ms d\theta + K_1\theta dt \quad \ldots\ldots\ldots\ldots\ldots\ldots 2.$$

the solution of which is

$$\theta = \frac{A}{K_1}\left(1 - e^{\frac{-K_1 t}{W}}\right)$$

where $W = M \times s$, the product of mass and specific heat.

Substituting for θ in equation 1 gives

$$Q = \int_0^T A\left(1 - e^{\frac{-K_1 t}{W}}\right) dt$$

$$= A\left[t + \frac{W}{K_1} e^{\frac{-K_1 t}{W}}\right]_0^T$$

$$= A\left[T + \frac{W}{K_1}\left(e^{\frac{-K_1 t}{W}} - 1\right)\right] \quad \ldots\ldots\ldots 3.$$

If on the other hand the heat input is from a source at constant temperature θ_s, and is proportional to the difference between this temperature and that of the solution $(\theta_A + \theta)$ where θ_A is ambient temperature, as in the case of a steam coil, it follows that

$$K_2\{\theta_s - (\theta_A + \theta)\}dt = Wd\theta + K_1 dt$$

or $$K_2(\theta_s - \theta_A) = \frac{Wd\theta}{dt} + (K_1 + K_2)\theta \quad \ldots\ldots\ldots 2.$$

which is the same form as equation 2 but with modified constants and the problem may be solved as before.

The factors K_1 and K_2 are in effect the product of the "U" value and surface area through which heat transfer is taking place. The "U" value is the overall coefficient of thermal conductivity and is a constant for any given heat barrier over reason-

*Development Engineer, Electro-Chemical Engineering Co Ltd.

ably large temperature ranges. Its value can be determined experimentally or obtained from published results.

Where the final temperature is above 150°F. the evaporation loss is of some consequence and since there is no simple relationship between the rate of heat loss and temperature there is no alternative but to consult tables of published data giving evaporation loss from liquid surfaces under various conditions and from them obtain an approximation of the heat loss. This will be a small proportion of the total and therefore any errors introduced will not seriously effect the result.

Keeping the solution at working temperature

The second criterion, that of assessing the heat input required to maintain the temperature of a process tank at a given value, necessitates consideration of the following factors :

1. Heat loss *via* solution surface.....Q_S
2. Heat loss *via* tank walls.....Q_T
3. Heat loss to or gain from immersed work Q_W
4. Heat loss to or gain from the process.....Q_E

To avoid confusion the case where the solution is above ambient temperature will be first considered. The heat loss from the surface is by convection, radiation and evaporation. The last, especially, is a rather difficult quantity to assess as it depends on solution temperature, air temperature, air velocity and the relative humidity. Data are however available in the case of water and for most practical purposes will be applicable to plating and cleaning solutions.

The heat loss from the tank walls will be proportional to the temperature difference and can be determined from the formula.

where $Q^T = UA\,\theta$ BTU per hr. .....5.

where U = overall coefficient of thermal conductivity in BTU per sq. ft. per hr. per °F.

A = exposed area in square feet.

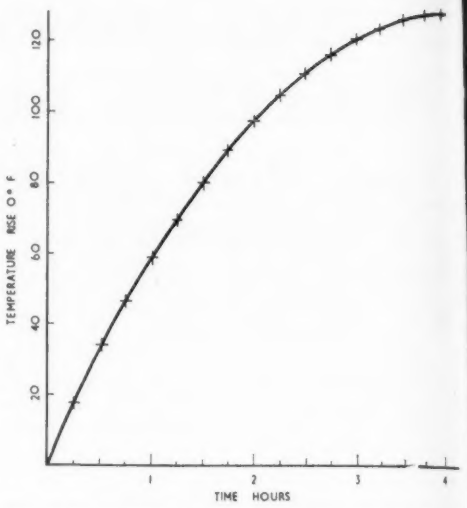
θ = temperature difference between solution and atmosphere in °F. with the reservations previously noted.

The work will gain heat according to the relationship

Q_W = Mass per hr. × specific heat x rise in temperature 6.,

which needs no further elaboration, except perhaps to mention that it is not always easy in practice to estimate the specific heat of some of the plastic covered racks used in plating processes.

In some electrolytic processes there is a considerable amount of heat evolved, in fact practically the whole of the electrical energy input is transformed to heat energy. This is readily assessed since the current input to the tank and voltage drop from anode to cathode will be pre-determined by the nature of the process. If the process is a new one



Typical temperature rise versus time curve for tank heated with steam at 50 lb. per sq. in.

a simple experiment on a small scale will generally suffice to provide the necessary data, *i.e.*, the current density and voltage drop required. This then gives

Q_E = Volts x Amps x 3.41 BTU per hr.....7.

Again in certain processes, such as acid pickles and etches, heat is liberated as a result of the chemical reaction. The amount of heat evolved in any given process can be determined from a consideration of the amount of metal removed, and the reaction associated with the process.

Another type of process which may be encountered involving heat loss is that of spraying. Apart from an addition to be made to the surface area to allow for losses from the circulating pipework in formula.....5., there will be a considerable loss from the spray. This loss is dependent upon the temperature of the spray, the rate of circulation, the type of nozzle and air circulation. It can only be determined from previous experience or experiment, although if the other factors remain constant it will be approximately proportional to the rate of circulation within the limits usually associated with spray washing.

The foregoing remarks apply to processes which are maintained at a temperature above ambient; installations have been made in tropical regions where this is not so and in these cases the same consideration will apply, but the heat flow will be from atmosphere. There will still be evaporation taking place unless the process temperature is below the dew point. In this case there will be a heat input from the condensation of water vapour, the magnitude of which will depend on the rate of condensation and the latent heat of

An automatic plating installation with a battery of electric immersion heaters.

vaporisation at the particular temperature considered.

Now if the temperature is to remain steady the heat input from the heat exchanger Q must balance with the sum of the above, *i.e.*,

$$Q = Q_S + Q_T + Q_W + Q_E$$

Choosing the Heat Exchanger

It is now possible to predict the maximum rate at which heat must be added or subtracted to the tank to satisfy all conditions, and it remains to decide the type of heat exchanger to be employed. In general it will only be necessary to heat the solution, although there are some processes which may require heating to bring them up to temperature and cooling to maintain them at a steady value.

Apart from direct heating there are three basic types of heat exchanger which are usually considered.

1. Coil or radiator immersed in the solution.
2. External heat exchanger.
3. Water jacket surrounding the tank.

Direct heating can be in the form of gas jet under the tank or an electric heater immersed in the solution. If the latter, the heater must be made of suitable material to withstand the action of the solution and there are very few solutions encountered in plating and cleaning processes in

A chemical mixing plant with two small tanks on the left heated with steam jackets.

which immersion heaters cannot be employed if desired. They have the merits of high efficiency and flexibility but are expensive to run. Gas heating is not used on automatic plant but is sometimes considered for small tanks.

The factors which influence the selection of a heat exchanger are :—

1. The heating load.
2. The heating medium (steam or high pressure hot water).
3. The solution.
4. The physical configuration.

If the solution is non-corrosive to steel there is little doubt that the coil immersed in the tank is to be preferred on the grounds of cost. If the solution is corrosive there may be other suitable materials such as stainless steel, copper or nickel which can be obtained in tubular form and fabricated into a heating coil. Steel homogeneously covered with lead has also been employed.

If, however, the load is very great the case for using an external heat exchanger should be considered, as the increase in efficiency may make it a more economical proposition. This will almost certainly be so where steel is unsuitable and a solution pump has to be provided for filtration purposes which is of sufficient capacity to circulate through the exchanger. Heat exchangers can be obtained to handle a variety of corrosive liquids but chromic acid appears to offer some difficulty.

A water or steam jacket surrounding the tank can be used for heating small volumes of corrosive solutions which do not permit the use of coils, but this is a very inefficient method and unless the heat load is small it may prove difficult to obtain the requisite heat transfer.

Where both heating and cooling are necessary it is usual to employ two separate systems. This results in a closer degree of temperature control than is the case where one heat exchanger is provided to handle both heating and cooling media, and is a much more simple arrangement for controlling their flow.

Size of Heat Exchanger

Having decided upon the type of exchanger to be employed there remains the final problem of ensuring that it is adequate in size to perform the requisite duty.

Two things must be checked.

1. That the area available for heat transfer is sufficient.
2. That the necessary flow rates of solution and heating medium can be obtained.

The heat transfer area is given by the fundamental relationship quoted above, *viz.*:

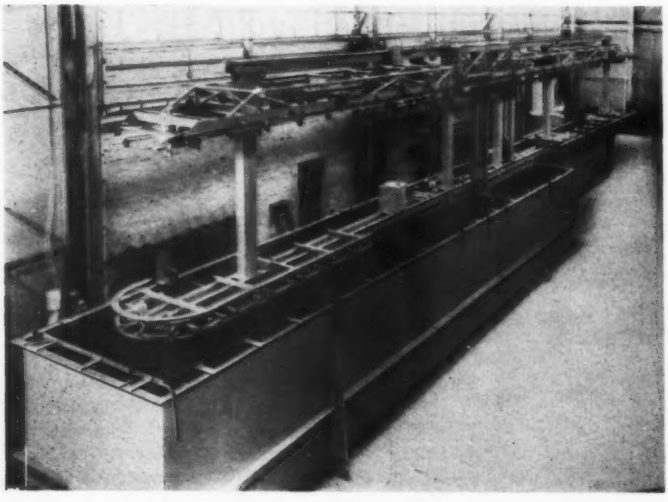
$$Q = UA\theta$$

Where θ is the difference in temperature between solution and heating medium. If these values are not steady the logarithmic mean value should be found although for small differences the arithmetic mean will be sufficiently accurate.

The value to be taken for U will vary from 50 BTU per hr. per sq. ft. per F. for water jackets with a low differential to approximately ten times this figure for a well designed heat exchanger operating under optimum conditions. It will also depend upon the rate of flow of solution and heating medium, which should be sufficient to give turbulent flow ; for any type of exchanger the value must be determined experimentally.

The flow rates are easily computed, since the

(*continued in page* 131)



An automatic plating plant in construction showing a steel coil attached to the side of the end tank.

New Refrigerator Painting Line features

FLOW-COAT PRIMING and ELECTROSTATIC FINISHING

at the Dundee Works of ASTRAL EQUIPMENT LTD.

OWING to the continually increasing demand for their range of domestic refrigerators, Astral Equipment Ltd., a subsidiary of Morphy-Richards Ltd., have recently doubled their manufacturing capacity at their Dundee Factory, and in the re-planning of their production lines, consequent on a new factory extension, the decision to instal a completely new finishing shop was taken, the existing equipment being completely inadequate for the new production schedules.

For some considerable time Astral Equipment have used a passivated zinc-coated sheet in the manufacture of the casing, door panel, etc. for all their range of refrigerators, and in consequence, when the new line was being set down it was decided that the only pre-treatment prior to painting required, would be degreasing, and in view of experience which they had had on their existing equipment the decision was made to degrease on the priming conveyor through a trichlorethylene unit.

As a result of considerable investigation it was decided that prime coat should be applied by means of flow coating, and jigs suitable for both the degreasing and the flow coating operation were developed. To suit the preceding and following processes it was decided that monorail conveyor systems should be used in the paint shop so that cabinets, door panels, etc. required to be finished would reach a loading area at the end of the production line and would immediately be transferred to the degreasing and prime coat painting conveyor. This conveyor system has an approximate endless length of 580 ft., and is provided with work carrying hooks at 4 ft. pitch throughout the entire length.

After degreasing, a length of conveyor has been allowed to permit of tack ragging, after which length the work passes to the flow-coating unit.

The flow-coating unit comprises an entering vestibule followed by the flow-coating section proper, and then an enclosed vapour tunnel to allow flow-out of the paint before stoving. The flow coater, as will be seen from Fig. 2 comprises a series of annular rings fitted with flow coating

Fig. 1.—*Diagrammatic representation of layout of new refrigerator painting line.*

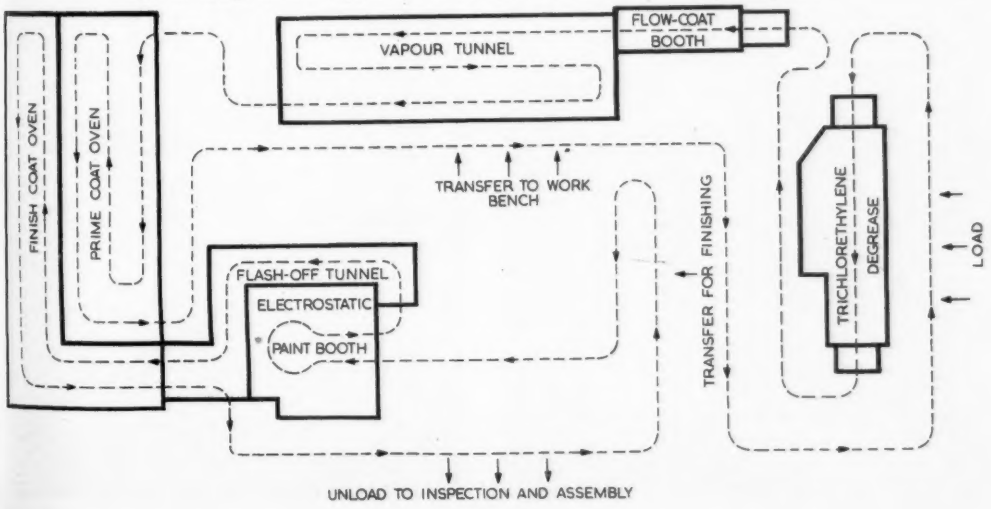


Fig. 2.—View of flow-coating unit showing arrangement of nozzles.

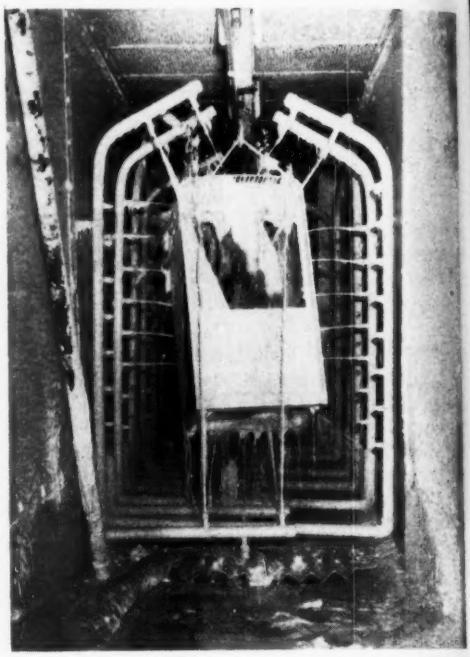
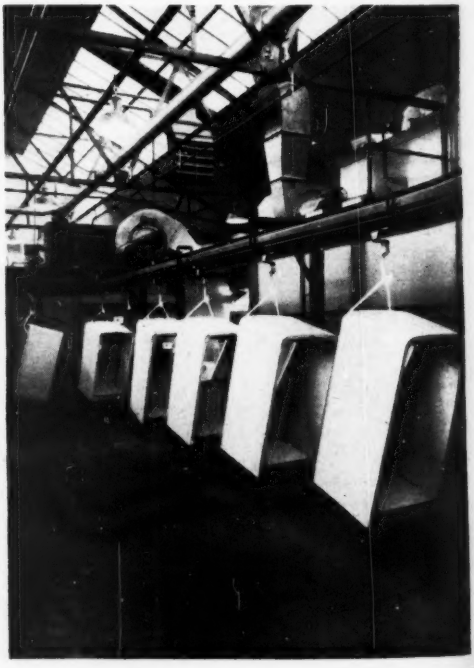


Fig. 3 (above).—Refrigerator cabinet entering the flow-coating unit.

Fig. 4 (below)—Work emerging from the prime coat stoving oven.



nozzles, the nozzles being arranged to cover both interior and exterior surfaces completely, the excess paint draining back to one of two working sumps ; Fig. 3 shows a cabinet entering the flow-coat section.

Each flow-coating ring is separately valved, and in addition to the two working sumps, a solvent tank is provided to enable the system to be flushed out as required. The arrangement of pipework is such that the circulating pump, which is of the positive pattern, can draw from either of the three sump tanks, the drains also being interconnected and valved.

In addition to the main circulating pump, a subsidiary pump is provided which is used during long shut-down periods, *i.e.* weekends etc. to keep the paint in good condition ; this pump is provided with a draw-off connection to enable, as required, the paint volume to be drawn off and barrelled.

With a conveyor speed of 7 ft. per min. the drain time after paint application is approximately 20 minutes, and during the whole of this time the work is in the vapour tunnel to give flow-out.

At both entering and exit ends of the flow-coat tunnel is provided a vapour seal to prevent the escape of solvent vapour into the surrounding shop area. Care has been used in the design of these seals to avoid draughts in the vapour tunnel proper, which, if present, would tend to set off

Fig. 5.—Work on the second conveyor system entering the electrostatic painting unit, the bodies having been inverted and other parts rejigged.

the paint locally and thus interfere with the flow-out.

After leaving the flow-coat vapour tunnel, the work is conveyed through a direct gas-fired air-circulated prime-coat-stoving oven, which has been designed to permit it the above conveyor speed of a travel time of approximately 16 minutes. The oven is provided with thermostatic control to enable working temperatures of up to 400°F. to be quickly and easily attained.

The heating and circulating equipment is mounted on the roof of the stove to conserve floor space and each heater is fitted with flame-failure safety controls and automatic ignition, a two-point temperature recorder also being provided.

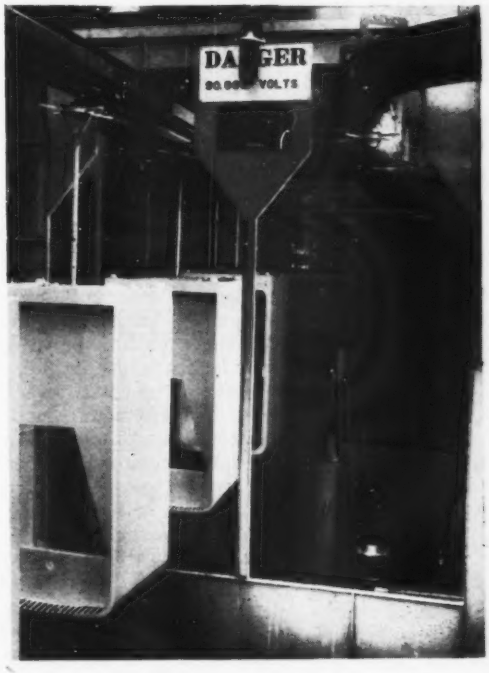
To prevent spillage of hot fume-laden air and, at the same time, toc onserve fuel, air seals are provided at entering and exit ends of the oven, the seals delivering high velocity air streams across the working opening, these seals also being designed to form silhouettes.

After emerging from the prime-coat stove, shown in Fig. 4 the work then traverses a cooling leg, which has enough space available to permit of any rubbing down which may be necessary. All the carrying hooks on the prime coat conveyor are of the fixed pattern.

The work is then removed from the jig used for conveying through the degrease and flow-coating unit and is re-hung on a second conveyor system, also of the monorail pattern, having a length of approximately 340 ft. and travelling at 6 ft. per minute, the refrigerator bodies being inverted as is shown in Fig. 5 and other parts being rejigged to suit the following electrostatic painting operation. All parts are tack-ragged on the finishing conveyor before reaching the spray booth.

(*Continued in page* 131)

Fig. 6.—The electrostatic painting unit with a number of refrigerator bodies being painted. The bell head for coating the top of the cabinets can be seen on the bottom right of the illustration.



FINISHING POST

A SELECTION OF READERS' VIEWS COMMENTS AND QUERIES ON METAL FINISHING SUBJECTS . . . . .

Advice on all aspects of metal finishing practice is offered on these pages, and while every care is taken to ensure the accuracy of information supplied no responsibility can be accepted for any loss which may arise in respect of any errors or omissions.

The Need for Secrecy in Proprietary Processes: a Further Comment.

Dear Sir,

The general thought behind your Editorial entitled " Formulae, Fears and Facts " in the December issue of the METAL FINISHING JOURNAL is well taken, and I believe generally accepted, especially by those involved in metal finishing research. We realize the lack of fundamental knowledge and continually hope that more basic research will be forthcoming.

However, in order to prove a point, statements or inferences are sometimes made which cannot be substantiated, or which, if true, are not important to the point in question. I believe your Editorial has succumbed somewhat to these kinds of arguments. I would like therefore to comment on some of the statements in your Editorial.

To the research worker the " present state of research in the science of metal finishing " is " somewhat depressing." We must remember however that to the general public and to private business this might not be the case. How much time and money goes into both basic and applied research, depends for the most part on the economics of the particular field. Most industrial firms are in business to make a profit and research is used for this purpose. The firm is not in business solely to support Research. This is also the reason that metal finishing practice outstrips theory, but this is certainly not characteristic of only the plating industry. I personally and selfishly would like to see millions of dollars or pounds put into the science of metal finishing but this is forgetful of the fact that there is a limit to the money available in a free economy. It would not be surprising to find that, per dollar sales, there is more research supported by the metal finishing industry than by many other industries. We in the U.S. admire the plating research groups you have in England ; University of Cambridge, Tin Research Institute, Imperial College, The Armament Research Establishments, British Non-Ferrous Metals Research Association and The British Iron and Steel Research Association to name but a few. We have similar groups, particularly the Bureau of Standards, in the U.S. but I believe you surpass us. However, we are especially proud of the AES Research Programme. Not many industries support research in their field as does the plating industry. This of course should not stop us from hoping for more.

As for the plating supply houses, it should be noted that several of them actively support plating research, where information can hardly be called " secret " when it is published in metal finishing journals. Similar information is available also in the form of published papers by graduate students having scholarships and fellowships supported by supply houses.

Regarding the research done by the plating suppliers, there is of course a certain amount of secrecy, but to say that this is almost unique to this industry is so ridiculous that the many examples showing the contrary will not be cited.

The statement is made that constituents and formulae cannot " be kept secret for more than a few days," but this you follow with a qualification. One might be interested in the constituents of an addition agent but there is a limit to how much he will pay in money and time to gain this knowledge. To name coumarin as an example is oversimplifying the case. There are good reasons why the term " Brightener B " is used rather than coumarin.

While the possibility of " plagiarism " is not the reason for secrecy, it might interest the Editor to know that this does occasionally happen. A " blanket of secrecy " is used partly to give us a few weeks or months head start on our competitors. Another reason is that in some cases, a little knowledge is worse than no knowledge' It is not uncommon for a user to think he knows more about a process than the supplier. This has been the cause of many difficulties. Still another reason is that in most cases it adds nothing to the science of useful knowledge, to use the chemical names of constituents. Would it be helpful if the names p-triaminodiphenyl-m-tolylmethane, N, N'-oxydiethylene-bis-(isoquinolinium) chloride, or N-ethanol-(B-hydroxyethyl)-4-nitro-5-(3'-pyridinium)

(Continued in facing page)

Finishing Post

(*Continued from facing page*)

pyrazole chloride were used in place of Brightener A, B, or C ?

Inference is made that it is all right for " matters of know-how " and " tricks of the trade " to be kept secret. Whether this is true or not I wouldn't care to judge, but in the U.S. there is a surprisingly large amount of free exchange of this type of information between competitors, suppliers and users. Also, lest I leave the impression that there is tight secrecy on addition agent composition, it should be pointed out that these are disclosed in patents, and quite frequently where advisable the composition is disclosed to users.

Since writing the above, we have received the January issue. We agree with Mr. Smart's comments ; in fact, there are some close duplications of thoughts.

A. H. Du Rose.
Harshaw Chemical Co.,
Cleveland, Ohio, U.S.A.

Assessment of Heating Requirements

(*Continued from page* 126).

amount of heating medium can be determined from the quantity of heat to be transferred. In the case of steam it will be necessary to consult steam tables to obtain a figure for the latent heat L and specific volume V_s at the pressure under consideration whence

$Q = WL$ where W is wt. of steam in lbs. per hr.

and vel. of flow $= \dfrac{W.V_s}{60 \times \text{Area of tubes in sq. ft.}}$

ft. per min.

This should be about 6,000 ft. per min. for most applications.

For high pressure hot water

Q = gallons per hour x 10 x temperature drop between flow and return lines.

and velocity of flow $= \dfrac{\text{gal. per hr.} \times 6.25}{360 \times \text{Area in sq. ft.}}$

ft. per sec.

A reasonable velocity for which is 8 to 12 ft. per sec.

This completes the survey of the factors involved in the problem of heating a process tank ; most of these necessitate a knowledge of the appropriate overall coefficient of thermal conductivity before they can be evaluated. As previously indicated there is no way of deriving these coefficients from theoretical considerations, owing to the complexity of phenomenon of heat transfer. However, once they have been determined for a given heat barrier, either from analysis of previous observations or by relevant experiments, the path is clear to apply the above reasoning.

It has been found that by considering the problem in its various aspects a much closer approximation to the heating requirements can be made, thereby either saving costs or preventing on equipment costly mistakes.

This article will have served its purpose if it encourages others towards a more thorough understanding of a subject which in the past has been the ground for a great deal of loose thinking.

New Refrigerator Painting Line

(*Continued from page* 129)

The electrostatic system used for the finish painting of all parts going to make up the finished refrigerator is the modified No. 2 (reciprocating disc) Ransburg system, shown in Fig. 4. The conveyor is arranged in a loop around the disc and is provided with indexing points around the loop.

A number of sets of indexing fingers have been provided, all of which are capable of adjustment around the loop, and are brought into and out of operation pneumatically from a selector station external to the booth.

In addition to the reciprocating disc, and to coat the top of the cabinet which, as mentioned above, is hung on the conveyor inverted, a spinning bell head is provided at the exit point on the spraying loop at ground level, to coat that area of the top of the cabinet not reached from the reciprocating disc. This can be seen in Fig. 5.

After leaving the electrostatic spray booth the painted work then traverses an enclosed flash-off tunnel provided with extract before reaching the finish-coat oven which, as in the case of the prime-coat oven, is of the fully air-recirculated pattern and arranged with direct gas-fired heaters, these also being mounted above the roof of the stove.

Air seals are provided as in the case of the prime-coat oven at entering and exit points and on leaving the oven the conveyor passes through the boundary wall of the shop and runs parallel to this wall, parts being removed from the conveyor at this point for inspection and transfer to the final assembly areas.

An important aspect of the line is that at no time is hand spraying or touching up used, complete coverage both in the case of prime and finishing coats being obtained by automatic means.

The layout finally installed was arrived at after prolonged study by Astral Equipment engineers, in conjunction with Stordy Engineering Ltd. who designed, manufactured and installed the finishing equipment, ovens etc. The conveyor system is of the Fisher and Ludlow " Flowlink " pattern, the electrostatic equipment being supplied by Henry W. Peabody Ltd., and the trichlorethylene unit by Imperial Chemical Industries Limited.

OCCA Exhibition . . .

News Note: More than 5,000 visitors from 20 different countries attended the latest and biggest of these annual shows. Sir Walter Warboys, B.Sc., D.Phil., Hon. A.R.I.B.A., president of the Association of British Chemical Manufacturers, chairman of the Council of Industrial Design, was chief guest at the opening luncheon held at the Criterion Restaurant, attended by 350 guests.

THE 10th Technical Exhibition of the Oil and Colour Chemists' Association was held at the Royal Horticultural Society's New Hall, London, last month. Organized by the London section of the Association, it covered the raw materials and equipment used in the paint, varnish and printing ink industries.

On the following pages appear details of the material that was displayed by some of the firms taking part.

Novadel Ltd.

*St. Ann's Crescent, London, S.W.*18.

THE products displayed on this stand comprised the latest technical developments in the company's established products and their application in the paint and allied industries. These included organic peroxide catalysts (used in surface coating polyester resins), stabilisers for halogenated vinyl compounds etc., anti-skinning agents of the oxime type, " Siccatol " driers, and white lead for undercoatings and hard gloss paints.

The company has specialized in the manufacture of organic peroxides for over 30 years. Most of these are used as catalysts for polymerisation of various synthetic resins. A considerable quantity of peroxides manufactured by Lucidol Products Division of Novadel Ltd. are used in the production of polyester resins, and an interesting piece of apparatus which the firm uses in the control of production and development work on organic peroxides is shown in Fig. 1. The apparatus was exhibited on the Novadel stand.

The equipment consists of the following items : (1) A thermostatically controlled water bath with thermometer, stirrer, heater and copper cooling coil. (2) A viscometer. (3) A gelation timer. (4) Thermocouple equipment.

The Novadel viscometer is a modified form of the falling sphere viscometer and it has been developed for rapid determinations of viscosities. It is sufficiently accurate for routine determinations of any transparent liquid, such as polyester resin or oils or mediums such as used in the paint and allied industries, and can be suitably used for viscosities falling between 3 — 200 poise. The accuracy is $\pm$ 2 per cent. at lower range increasing to $\pm$ 5 per cent. at the higher viscosity.

The viscometer comprises a U-shaped metal frame with two bars, set at a calculated distance apart, bridging the U. The bars are provided with holes to take 6 in. x $\frac{5}{8}$ in. test tubes which are filled with a sample of the oil or medium under test. The spheres used in this viscometer are 2-mm. dia. steel balls.

The distance apart of the bars referred to above, the diameter and weight of the steel balls and the diameter of the test tubes, are each arranged so that — when the sample is undergoing test — the time of fall in seconds of the steel ball between the centres of the top and middle bars is equal to the viscosity in poises.

The gelation timer is manufactured by Techne (Cambridge Ltd.,) Duxford, Cambridge, and is based on simple fundamental principles.

A weighted disc immersed in the resin is subjected to a simple harmonic vertical motion, with a periodic time of one minute, by connection to a geared synchronous electric motor. As the resin sets, a point is reached at which the stiffness is sufficient to support the weight of the disc during a thirty seconds half cycle ; up to this point, the connecting link has been under tension both during the up and down strokes, but as soon as the disc is supported, the link on its down stroke

Fig. 1.—*Apparatus used in work on organic peroxides (Novadel).*

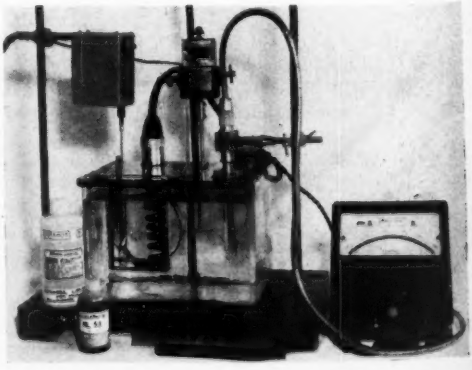


Fig. 2.—At the rear of the Shell stand — the apparatus used for "blush" assessment.

becomes subjected to a compression causing an electric contact in the link to close a circuit. This in turn opens a relay irreversibly, stops the synchronous motor, and lights a small neon lamp, to attact attention. The gelation time is then read off in minutes on the counter and, after resetting, the apparatus is ready for another determination.

The temperature indicator, which can be seen at the right hand side of the bath, is connected to a needle type thermocouple, which is immersed in a polyester resin. This equipment, manufactured by Ether Ltd. (Birmingham), is used for testing the exothermic reaction of polyester resins during the polymerisation effected by use of the combination of an organic peroxide and a suitable accelerator.

Shell Chemical Co. Ltd.

170 *Piccadilly, London, W.*1.

TWO main groups of Shell products were featured, namely solvents and "Epikote" resins.

The theme of the solvents exhibit was Shell developments in solvent technology. On view was a model of a blush assessment apparatus (this can be seen at the rear of the stand illustrated in Fig. 2) which is the latest development of scientists at the technical service laboratories of the company at Egham, Surrey.

This apparatus, claimed to be the first of its kind, has been designed to enable laboratory study of blush tendencies of nitrocellulose lacquers under conditions occurring in normal practice. Details were also available on the valuable properties of ketones, alcohols and other Shell solvents in relation to surface coating formulation.

The "Epikote" exhibit demonstrated the advantages of "Epikote" resins when used to modify other film-forming materials such as silicones, coal tar and alkyds.

"Epikote" resin/silicone finishes have good resistance to water; the "Epikote" resin/coal tar combinations have excellent solvent and water resistance and improved thermosetting qualities, and the "Epikote" resin/alykd finishes give increased alkali resistance.

Steele and Cowlishaw Ltd.

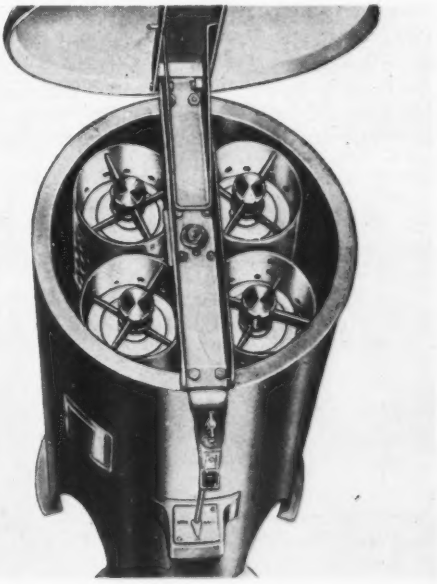
Cooper Street, Hanley, Staffs.

THIS stand presented several machines of interest to the metal finishing trades including, besides their conventional ball mills, a series of high-speed ball mills, kinetic dispersion mills and paint rejuvenators.

The Steel-Shaw high speed ball mill Mark I, illustrated in Fig. 3, is particularly interesting to manufacturers of frit and vitreous enamels. A simple system of varying the size and type of the ball charge was evolved for the mills to ensure a predetermined range of particle size in the processed slip with the percentage of each size group balanced to within 5 per cent to 6 per cent of the optimum and giving a product range of 70 to 40 microns, the normally required sizes.

Slips of coarser and finer nature than these are easily achieved, if desired. The actual time for processing frits varies between 5 and 15 minutes. As the Mark I mill is designed for laboratory work it is now possible for faulty batches from production runs to be detected within 15 minutes of the sample reaching a control laboratory.

Fig. 3.—For makers of frit and vitreous enamels — a high speed ball mill (Steele and Cowlishaw).



To achieve such speed the design incorporates four removable and interchangeable pots which are placed vertically and revolve at high speed around a central drive. This sets up a powerful centrifugal force which holds the grinding media and charge against the wall of each pot.

The pots are also geared to simultaneously revolve in the opposite direction on their own axis thus causing activation within the mass of the grinding media and charge. The total result, using many times the gravitational force available in conventional ball mills, gives a greatly accelerated grinding action.

For organisations using and storing large quantities of paint the company also featured a varied range of paint rejuvenating machinery including the new " Quickway " paint conditioners for tins of ¼ pint to 1 quart and 1 quart to 1 gallon capacities; and 5 larger machines for rejuvenating paint in 5-gallon drums, ranging from a 2-unit to a 12-unit model.

British Titan Products Co. Ltd.

10 *Stratton Street, London, W.*1.

FOR many years the titanium oxide content of paints has been restricted because the pigment has not been available in sufficient quantity to allow the optimum pigmentation of all lines.

As the world supply of titanium oxide improves, the paint formulator is given greater freedom in this respect, and the company's exhibit showed the extent to which the titanium pigment content of paints may be increased to obtain the best results.

The exhibits were confined to air drying systems of gloss, undercoat and flat wall paints.

The possibility of obtaining one coat " hiding " with white gloss paints over undercoats of varying colour and reflectance was examined with respect to pigment content. (Fig. 4). In gloss paints, also, the effect was demonstrated of making pastel shaded paints with increasing amounts of titanium oxide.

Fig. 4.—One coat " hiding " with white gloss paint over undercoats of varying colour (British Titan Products).

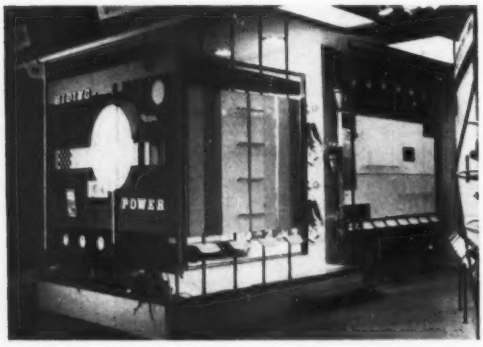


Fig. 5.—Well to the fore — airless spraying equipment (Distillers Co.).

Rutile and anatase pigments were compared for hiding power at equal pigment/binder ratio and at equal cost.

In flat wall paints, the type of extender, titanium pigment content, and the total P.V.C. of the paint were varied to show their effect on hiding power over a range of differently coloured backgrounds. Reference was made to the difference between the wet and dry hiding power of paints.

Finally, it was demonstrated that it is possible to formulate a single coloured undercoat for use under all pastel shaded finishes.

The Distillers Co. Ltd.

172/3 *Tottenham Court Road, London, W.*1.

REPRESENTING The Distillers Co.'s. chemical interests at the exhibition were British Industrial Solvents and Honeywill and Stein Ltd.

The B.I.S. contribution fell into two classes:

(1) the results of investigations on the fundamental properties of compounds used in the paint and allied industries, and

(2) the application of " BISOL " materials in established and new techniques.

Under the first heading, the evaporation rates of some high-boiling solvents have been determined at a relatively high temperature (150°C.); these results will be of particular interest to those concerned with heat-set printing inks and heat-dried finishes.

Under the second heading, B.I.S. reports the final stage in the planned series of experiments on solvent evaporation which have been a feature of studies over the past four years. Starting with work on simple solvents, previous exhibitions continued with binary and more complex mixtures;

the series was concluded at this 10th O.C.C.A. exhibition with the results on evaporation from standard lacquer films, composed of nitrocellulose, resins, and solvent mixtures of various types.

Conditions during the range of 60 - 80 per cent. evaporation, at the stage of film "set-up," govern much of the final appearance and physical properties of the dry film, and the preponderance of an active solvent during this period results in improved blemish-free finishes. It has been established that, using an ester mixture, the ester remains far in excess of the diluent during this critical stage, whereas with ketones, the ketone : diluent ratio approaches 1 : 1.

The advent of the airless spraying technique (seen displayed on the stand in Fig. 5) has meant a drastic revision in lacquer formulations. In this method the lacquer is "atomised" by high pressures, and high temperatures. Low boiling solvents with high vapour pressures are therefore required, and a selection of suitable solvents from the "Bisol" range were displayed. Specimen panels prepared by Cellon Ltd., showed the difference in film quality when application is by the "airless" and "compressed air" techniques, and airless spraying eguipment supplied by T.C. Spray Finishing Systems was on view.

Among the new compounds displayed was Bisoflex 108A (an adipate of mixed alcohols), the latest addition to the Bisoflex range of plasticisers for P.V.C. and vinyl copolymer resins. Its low temperature properties were demonstrated.

The Honeywill and Stein display included sebacic acid and iso-sebacic acid, the latter now available in this country for the first time. This new and, so far as British industry is concerned, relatively untried acid gives rise to esters which are economical in price and yet have plasticising powers similar to the well-known sebacates.

Evans Electroselenium Ltd.

Colchester Road, Halstead, Essex.

THE importance of measuring gloss in the paint, paper and plastics industries has long been recognised, and the manufacturers of the "Eel" high and low gloss heads, Evans Electroselenium Ltd., had on display on their stand, a new photo-electric instrument — an adjustable gloss head — to take measurements of gloss at varying angles.

Designed to operate in conjunction with the standard "Eel" galvanometer unit, it provides a means of measuring the gloss of a sample at any desired angle over the range of 15 - 85 deg. It comprises a lamp unit and photo-cell unit, both of which are mounted with a separate pivoted lever. The lever arrangement is fitted to a stout base plate and has a light-tight cover. A recess at the front of the instrument accommodates a sample up to 6-in. in width, and a spring clip holds it firmly against the aperture.

In operation, the galvanometer is adjusted to a reading of one hundred divisions with the standard in position, after the photo-cell and lamp units have been set to the desired angles. The standard is replaced by the sample and the reading noted.

Also on display on this stand were the following instruments, made under the "Eel" trademark, all having particular applications in the paint and allied trades :—

Photo-extinction sedimentometer for determining size characteristics of powdered materials in the sub-sieve range.

Powder reflectometer for the determination of specific surfaces of powders of less than one micron.

Gloss head, developed for the rapid and accurate measurement of high gloss.

Low gloss head to provide a measure of gloss in the region of matt finish to medium gloss.

Mark III reflectometer for routine measurements of total brightness and opacity.

Reflectance spectrophotometer, approved by the Printing, Packaging and Allied Trades Research Association for quick, accurate assessment of spectral characteristics of a colour and for off-white measurements.

Haze meter for measurements of haze and luminous transmission of transparent plastics according to ASTM D.1003-53.

Imperial Smelting Corpn., Ltd.

37 Dover Street, London, N.1.

EXHIBITS on the stand of the Imperial Smelting Corpn. Ltd., demonstrated how the products of their associated companies, Orr's Zinc White Ltd. and Fricker's Metal and Chemical Co. Ltd. serve the paint and allied trades.

The formulation of emulsion paints using Orr's zinc sulphide pigments was illustrated with respect to hiding power, exterior durability and general appearance. The use of these pigments in undercoats was also featured.

Fricker's zinc oxides were shown in gloss paints after exposure under both interior and exterior conditions. The excellent gloss and colour retention associated with these pigments was displayed.

Orr's zinc tetroxychromate was featured as an anti-corrosive priming pigment for both light metals and steel by exposure test panels.

A new addition to the sales range, Delaville superfine zinc dust, was shown. This pigment is outstanding for freedom from coarse particles and consequently is valuable for priming paints where smoothness of the surface and a high degree of finish of paint systems is required.

Like Delaville 95/97 per cent. and Fricker's

Superfine grades, it is made by distillation and contains a minimum of 95 per cent. metallic zinc. It differs, however, from these dusts in so far as it shows practically complete freedom from particles in the normal sieve range, i.e. particles of 53 microns upwards, which would be retained on a B.S. No. 300 sieve. Delaville Superfine zinc dust is also finer in the sub-sieve range, very few of the particles being larger than 20 microns and a major proportion being less than 10 microns in size, when analysed by a sedimentation technique.

Comprehensive exposure testing of zinc dusts in paints and metallic primers has shown that it is inadvisable to have too small an average particle size. Corrosion resistance in metal primers is inclined to be lowered where very fine sized dusts are used because :

(a) More paint thinners are required to give brushable paints, and the dry paint films therefore tend to contain lower weights of zinc.

(b) More rapid sacrifice of the zinc particles tends to occur due to more rapid electrochemical action.

Erosion also tends to be heavier where very fine zinc dusts are used in finishing coats. The makers say that the size range of Delaville Superfine zinc dust gives a highly effective compromise between the maximum corrosion resistance shown by larger sized dusts and the perfection of surface finish and better storage properties associated with very fine sized dusts. For this reason, Delaville Superfine is generally suitable for general use in paints for metals.

Finally, the range of Orr's barium chemicals was displayed with particular emphasis on fine particle blanc fixe, a pigment for use in printing inks.

Research Equipment (London) Ltd.

64 Wellington Road, Hampton Hill, Middlesex.

THIS company is well-known as manufacturers of scientific instruments and their display consisted of those having a special application to both manufacturers and users of paints.

Of interest to paint users was a newly-developed apparatus, designed for testing paints, varnishes, lacquers, linoleum and electro-plated coatings against abrasion (Fig. 6)

Built on a heavy cast aluminium base to ensure freedom from vibration, all rotating parts run on ball bearings. It is intended for use where a single-headed machine is unable to handle the required volume of work. Six panels can be tested simultaneously, and each of the wear-heads is interchangeable.

The heads most commonly used with the apparatus are either nylon filled brushes or rubber pads covered with nylon twill. The machine has been arranged so that the panels can be tested either dry or under a stream of continuously changing water.

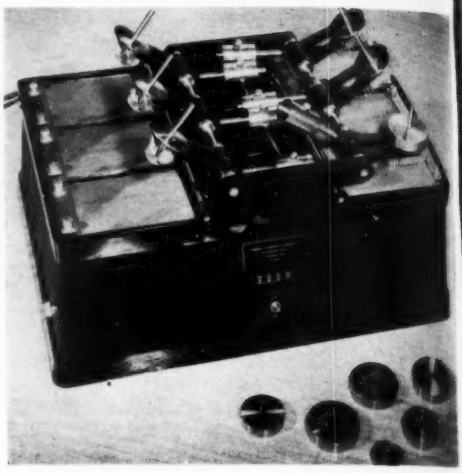


Fig. 6—A multi-head abrasion test apparatus has provision for weight adjustment (Research Equipment)

The weight on the wear-heads is adjustable, and a four-figure resettable counter records the number of strokes used.

Among some of the other instruments on display was the firm's " fineness-of-grind " gauge. Consisting of a hardened and ground steel plate with two channels cut in the upper surface, the gauge is designed for the measurement of fineness of grind, and is invaluable for the control of milling operations.

The depth of the channels is calibrated on the gauge, and the instrument is supplied with a hardened and ground doctor blade.

In use, a blob of paint is dropped into one of the channels at its deep end and drawn over the full length by the scraper blade. After the draw-down, the film is viewed at grazing incidence and the point noted at which the pigment particles merge into the film. The two channels are provided so that comparisons may be made with a control sample.

Also exhibited was an apparatus for testing the behaviour of paint films under an applied flame. The equipment comprises an open fronted oven approximately 18 in. x 12 in. x 12 in., constructed in fireproof insulating board. Two runners are provided to hold the 12 in. x 12 in. panel vertical and a circular gas burner, adjustable in relation to the panel, is fitted to the lid. A baffle plate and two water manometers are also provided.

In use, the gas burner is adjusted to be 1 in. from the painted surface of the panels under test, and the flame is then adjusted so that an unpainted panel will become red hot in 20 seconds. Air and gas pressures are kept constant throughout the

test. The maximum temperature of the flame is directed onto the panel instantaneously at the commencement of the test by screening the steel panel with an asbestos sheet while the flame is adjusted to its correct proportions. The screen is then quickly withdrawn and the flame allowed to play on the panel for 60 seconds.

During this period, observation can be made on the behaviour of the paint film for signs of flashing, blister formation, ignition or carbonised residue, and peeling and flaking from the steel panels of the ashed residue. After cooling, further examination is made and the panels are photographed.

A simple hardness tester, designed to measure the hardness of a paint film by comparison with plate glass, was also on view. It consists of two 4-in. chromium-plated rings, spaced 1-in. apart with a pendulum supported between the rings operating against a scale. The rocker is drawn over to one side until the pendulum hits the stop, and is then gently released. The number of swings is then counted and compared with the result from plate glass.

Instruments for the assessment of sheen, for scratch testing, for resistance to slip or impact, and apparatus for determining the hard drying times of paint were also exhibited.

Spelthorne Metals Ltd.

Batchworth Wharf, Rickmansworth, Herts.

THIS company's stand comprised a large number of test panels showing the effect of marine and chemical attack on primers containing combinations of " Spelthorne " metallic lead and other pigments, and a number of photographs illustrated the varied protective uses of metallic lead paints.

Due to the very fine particle size, an average of one micron or one twenty thousanth of an inch of the lead paste, the product of this company has been called " atomised lead ". Finely divided metallic lead is an inhibitive pigment which has been used for many years as a constituent of protective paints for ferrous metals, and suitably formulated metallic lead paints give excellent protection against corrosion. Even where rust appears on a fractured surface, there is no " creep " under the paint film, and it can be used satisfactorily in the formulation of protective dipping paints.

The use of metallic lead paints covers a very wide field, and is a worthwhile constituent of priming paints for galvanised surfaces and for the repair of partially rusted galvanised iron.

Although metallic lead paints are relative newcomers to the marine world, their use in this field has been highly successful, and ships of all types are now being protected, both above and below the water-line, with paints based on " Spelthorne " lead.

To augment the display of test panels, the company had prepared a brochure listing the standard type of paints available together with the specification of each. This, together with other informative literature, is available on request.

F. W. Berk and Co. Ltd.

Berk House, Portman Square, London, W.1.

PRINCIPAL feature on this stand was Bentone, manufactured in three grades, for use in surface finishes to give improved pigment suspension, particularly at elevated temperatures.

On show was a decorative gloss paint, with titanium dioxide pigment and Bentone 34, which had successfully passed tropical storage of 12 months at 120°F.

Also exhibited were 2 samples of Bentone 38 containing epoxy ester coating, one that had been standing at room temperature for a month and another at 120°F. for a similar period. Reduction of floating, flooding and sag was shown also, together with improved acid resistance after partial immersion of coated panels in 10 per cent sulphuric acid for half an hour and for ten hours.

To demonstrate the product's temperature stability, two panels that had been coated with (a) epoxy, and (b) polyester systems, with and without Bentone, were exhibited. There was no flow in either of the Bentone-containing systems at curing temperatures of (a) 120°C. and (b) 160°C.

For use as filter aids in giving improved clarity, or as flatting agents or extenders, many grades of Dicalite diatomaceous earth were exhibited.

Dunlop Rubber Co. Ltd.

Compositions Divn., Chester Road, Erdington.

SOME properties of emulsions that have been developed during the past year to meet the specialised requirements of individual customers were demonstrated on this stand. The demonstration included gloss and adhesion properties, and a formulation that should meet requirements for recent Government specifications.

As an extension of the exhibit last year on test methods, an apparatus to measure emulsion stability, used in testing new polyacrylate emulsions, was shown.

In use, the emulsion is placed within the field of ultrasonic vibration emitted from a crystal transducer operating at 650 kc. The crystal is powdered by the valve oscillator connected through a transformer. Ultrasonic vibrations supplied at 60 w. caused aggregation and sediment of polymer particles. An oil bath served as an insulant, coolant and a dielectric medium.

Where the trace, depicted on the instrument's screen, was stable at high amplitude, it indicated that the emulsion under test would be mechanically

stable for an indefinite period. Where a reduction in amplitude was noted after 2-3 hr. it could be assumed that instability would almost invariably result.

In some cases the presence of normal amounts of residual monomer can interfere with the storage properties of the paint, and the company had on show substantially monomer-free grades of " Polimul " emulsions.

Amalgamated Oxides (1939) Ltd.

Victoria Works, Dartford, Kent.

As manufacturers of zinc dust, this company have carried out a great deal of development work on the formulation and use of zinc rich paints. These paints, since the war, have been established in this country and abroad, as being in the forefront of metal protective systems. At past O.C.C.A. exhibitions, and in previous publications, work on now accepted types of zinc-rich paints, based on organic binders, has been reported by the company. These binders include polystyrene, chlorinated rubber, isomerised rubber, epoxy resins and esters, and polyvinylacetate. This year their exhibit was completely given over to reporting results obtained with an entirely new formulation based on sodium silicate giving an air drying insoluble film.

The use of sodium silicate zinc dust mixtures as corrosion inhibitors is not in itself a new development. Such coatings have been known since before the war, but have in the past required some kind of after treatment to produce insolubility. In the main, this after-treatment has consisted of stoving, and coatings of this type are enjoying considerable success in Australia and the United States. In Australia the most spectacular example of their use is the protection, under a financial guarantee of 20 years' life, of a 240-mile run of overland water pipeline from Whyalla to Morgan in South Australia. (This job was completed in 1941 and is still showing no signs of breakdown.) Other methods claimed to produce insolubility consist of after treatment with phosphoric acid, sodium chloride, sodium hydrogen phthalate and many others.

In essence, the formulation developed by the company consists of producing an insoluble silicate varnish by precipitating a small proportion of silica gel in high silica ratio sodium silicate. The maker says that this varnish, coupled with the high reactivity of Zincoli superfine zinc dust (620), can produce an insoluble film in as short a time as fifteen minutes.

Having produced a practical formulation, work on the application of the material under conditions of normal atmospheric weathering, atmospheric weathering combined with elevated temperatures, and marine immersion has been carried out and the results of such work were illustrated at the exhibition.

Since the development of the formulation is comparatively new, exposure tests under atmospheric conditions are not, as yet, of sufficient longevity to allow very definite conclusions to be drawn. A steel panel was exhibited showing complete protection afforded by a single and double coat of a formulation, produced at the very early stages of the development programme, after 2½ years' exposure. Another panel showed a much later formulation after 6 months' exposure.

A need in industry has been for an efficient protective system for mild steel in the atmosphere subject to temperature variations from cold to temperatures above which normal protective systems disintegrate. Tests carried out using zinc dust sodium silicate coatings for this purpose show that protection up to 500°C. is possible for periods up to two years. Coloured transparencies were shown, illustrating the effectiveness of such coatings for 1 and 2 years on mild steel cooling towers. A Ford " Popular " exhaust system coated with the material showed complete protection where the temperature was 500°C. or below, but breakdown of the film due to oxidation of the zinc dust at temperatures above 500°C., under highly corrosive conditions.

Tests on organically bound zinc rich paints under conditions of marine immersion showed such coatings to have excellent anti-corrosion properties and marked anti-fouling properties. The addition of small quantities of toxic pigments improved the toxic properties of the paints, but tended to disrupt the films. Electrolytic copper powder only gave reasonably satisfactory results but still gave films prone to blistering.

Tests were carried out with zinc dust sodium silicate paints under these conditions and several very interesting points emerged. Even without toxic additives these coatings displayed a very high degree of antifouling efficiency and very small additions of metallic copper powder were sufficient to produce 100% efficiency. The anti-corrosion properties were probably superior to the organically bound paints, and the film after a short period of immersion developed outstanding abrasion resistance and remained completely free of blisters. Panels immersed off the south coast of England for periods up to two years were shown on the stand and illustrated that protection from both corrosion and fouling over this period was possible with these coatings.

Continuation

Several other companies not mentioned in this account of the exhibition had on show material of considerable importance to the metal finishing trades, and a description of some of these exhibits will be included in the next issue of the journal.

FINISHING

NEWS REVIEW

MORE NICKEL AVAILABLE

NET earnings of The International Nickel Co. of Canada Ltd., and subsidiaries for the year ended December 31, 1957, were $86,141,000 in terms of U.S. currency, equal to $5.90 per common share, the third highest in the history of the company, according to the annual report issued to shareholders by John F. Thompson, chairman of the Board, and Henry S. Wingate, president. Primarily because of the sharp drop in the price of copper, these earnings were some 10 per cent lower than the $96,296,000, or $6.50 per share earned in 1956, when earnings were the highest for any year.

International Nickel operated at capacity for the eighth consecutive year. Deliveries of 290,050,000 lbs. of nickel approximated the all-time high established in 1955, and copper deliveries were above those of 1956. Pushing to increase the company's annual nickel-producing capacity to 385,000,000 lb. in 1961, full-scale development and construction work is progressing on schedule at its new nickel project in Manitoba, and long-range development of its operating mines in the Sudbury District of Ontario is continuing.

Deliveries of metals

Deliveries of nickel in all forms in 1957 amounted to 290,050,000 lbs., compared with 286,140,000 lbs. in 1956. Refined copper deliveries were 280,810,000 lbs., compared with 271,300,000 lbs. in the previous year. Deliveries of platinum metals — platinum, palladium, rhodium, ruthenium and iridium — declined about nine per cent to 339,400 oz., while cobalt deliveries rose to a new high at 2,400,000 lbs. Deliveries of iron ore, also recovered from the company's Sudbury ores, amounted to 113,000 long tons, compared with 71,000 long tons in 1956.

Turning point for nickel supplies

"The year 1957 marked a turning point for nickel," the report stated. "During the latter part of the year the supply of nickel, after meeting defence requirements, exceeded civilian demand for the first time

(*Continued in page* 146)

INSTITUTE OF VITREOUS ENAMELLERS

Annual Conference to be held in Scotland

THE preliminary programme for the 1958 annual conference of the Institute of Vitreous Enamellers was announced recently. It is to be held at Gleneagles from June 16 to 18, and will include a day spent in Falkirk. A programme has been arranged for ladies accompanying the delegates that will include motor coach excursions in the area and a visit to Perth, in addition to the visit to Pitlochry.

PROGRAMME

Monday, 16th June

9.30 a.m. ANNUAL GENERAL MEETING at Gleneagles Hotel.
10.15 „ PRESIDENTIAL ADDRESS by W. T. Wren, Esq.
11.00 „ TECHNICAL SESSION I. "Works Management and Human Relations."
1.00 p.m. Luncheon.
2.15 „ TECHNICAL SESSION II. "Abrasion Resistance Tests."
3.15 „ TECHNICAL SESSION III. "Flame Spraying of Refractory Coatings."
4.15 „ Tea.
5.00 „ Golf Tournament and Recreational Activities.
7.45 „ Presidential Reception.
8.30 „ Dinner.
9.30 „ Dancing and Recreational Activities.

Tuesday, 17th June

9.15 a.m. Depart Gleneagles Hotel for day in Falkirk and WORKS VISITS to :—
1. Smith & Wellstood Ltd.
or
2. M. Cockburn & Co. Ltd.
or
3. Carron Company.

12.30 p.m. Luncheon at Ice Rink.
1.45 „ TECHNICAL SESSION IV. "Zirconium Bath Enamels."
2.45 „ TECHNICAL SESSION V. "Steel Shot and Grit for Vitreous Enamelling."
5.00 „ Tea at Gleneagles Hotel.
5.45 „ Recreational Activities.
7.30 „ RECEPTION prior to
8.00 „ ANNUAL BANQUET.
9.30 „ Dancing until 1.00 a.m.

Wednesday, 18th June

10.30 a.m. Depart Gleneagles Hotel for visit to the Hydro-Electric Plant at Pitlochry and Clunie including a motor coach excursion of the Tummel Valley. Luncheon will be taken during the visit.
4.30 p.m. Tea at Gleneagles Hotel, followed by the conclusion of the Golf Tournament and other recreational activities.
8.30 „ Golf Dinner followed by Dancing or other activities.

Recreational Facilities

Any person who will be attending the Conference and is interested in taking part in the golf tournament should advise the Secretary so that the necessary arrangements can be made.

Apart from the golf tournament other recreational facilities available during the Conference will include tennis, swimming, squash, pitch and putt, table tennis, snooker, billiards and bowls.

Reservations

It should be particularly noted that all reservations for this Conference including hotel will be made through the Secretary's office, to where all requests should be addressed, and not to the hotel direct.

PRIVATE BAR

GREAT believers in the use of humour to oil the wheels of industry, Accles and Pollock Ltd. the tube makers of Oldbury, Birmingham, have discovered that there is always someone ready to take them seriously.

Last Christmas they sent out a Christmas card incorporating a piece of very fine tubing that had an internal diameter of about 0.001 in. A correspondent signing himself "An Old Tubemaker" has recently written to the firm to say that he has calculated that a thousand km. of the tubing would weight 78.3 kg., and that to produce the tube from an original bar, the bar would have to be elongated one million times, supposing it had an original diameter of 112.6 mm. He concludes by referring to the remarkable quality of steel that can withstand this elongation.

SALES AGENCY

APPOINTMENT of Electro-Chemical Engineering Co. Ltd., Woking, has been announced as exclusive sales representatives in Great Britain for products of the Acme Manufacturing Co., Detroit, U.S.A., who have recently started to manufacture automatic and semi-automatic polishing machines in a new factory at Neu-Isenburg, near Frankfurt-am-Main, Germany, built to supply equipment to the European and non-dollar markets.

Stocks of essential spares will be held, and machinery installation made, by Electro-Chemical Engineering.

Houseware Shows in the U.S.

British Participation in American Exhibition

THE next summer and winter sessions of the National Housewares Exhibition and the Independent Housewares Variety and Novelty Merchandise Exhibit are to be held from July 7 to 11, 1958, in Atlantic City, and January 15 to 22, 1959, in Chicago.

The larger of these two shows, the National Housewares Exhibition, is considered to be the most important national exhibition in the houseware field in the United States.

At the last show held in January this year, all the imported merchandise on show was displayed by the American distributors or subsidiaries of the overseas manufacturers and there was no direct participation by foreign firms. Altogether, out of 45 firms exhibiting imported goods, 26 showed British merchandise. Manufacturers interested in these shows should ask their agents to get in touch with the organizers without delay at the following addresses :—

National Housewares Exhibition
National Housewares Manufactures Association, 1140 Merchandise Mart, Chicago 54, Illinois.

Independent Housewares Variety and Novelty Merchandise Exhibit
Independent Housewares Exhibit Inc., 8 South Dearborn Street, Chicago 3, Illinois.

NOISE CONFERENCE

A CONFERENCE on noise (particularly in industry) was organized by the British Occupational Hygiene Society recently. The conference was addressed by Mr. T. E. Cawthorne, F.R.C.S., of King's College Hospital, who discussed the physical disturbances produced by excessive noise, while Dr. T. S. Littler of the Wernher Research Unit on Deafness described the techniques of measuring noise. Dr. A. E. Carpenter, Applied Psychology Research Unit of the Medical Research Council dealt with the disturbance of mental performance caused by noise, and the final aspect of the problem, the suppression of noise was dealt with by Mr. N. Fleming and Mr. W. C. Copeland of the National Physical Laboratory.

The scientific secretary of the Society is Dr. D. Turner, The Associated Ethyl Co. Ltd., Ellesmere Port, Cheshire.

Price Drop

PRICES of the principal grades of titanium pigments marketed by British Titan Products Ltd., 10 Stratton Street, London, W.1., were lowered recently. For the Rutiox and Anatase grades, the reductions range from £2 to £7 per ton, for minimum 10 cwt. lots.

A revised price list is available from the company on application.

BATTELLE PRESIDENT FORMS OWN COMPANY

THE president of the U.S. Battelle Institute, Dr. Clyde Williams, resigned his post recently to form a new company to assist industry with broad technical and business problems.

The new company will provide services in research programming and administration, in the application of science and technology to industry, and in problems of business organization and operation. The other important phases of the company's activities will include the finding of new products to develop, and company acquisitions and mergers.

Address of the company, known as Clyde Williams and Co. is : 50 West Gay Street, Columbus 15, Ohio, U.S.A.

Dr. Williams will continue on the board of directors of Battelle, and will also serve in a consulting and advisory capacity.

VACUUM DEPARTMENT

LESS than 12 months after receiving Treasury approval to the agreement under which Wild-Barfield Electric Furnaces Ltd. of Watford are manufacturing vacuum arc, induction and resistance furnaces and vacuum analysers to the designs of National Research Corporation, Massachusetts, U.S.A., the Company reports the setting up of a completely new design and production department for vacuum equipment, to work closely with its counterpart at N.R.C.

TENDERS INVITED FOR POWDER PIGMENTS

THE Rialco Company Inc., Nemazy Khosrowshahi Building, Ave Saadi, Teheran, have informed the British Embassy at Teheran that they would like to receive offers from United Kingdom suppliers of the following materials required by their factory, though they cannot yet give any accurate estimate of what their regular requirements will be : enamel powder ; decarbonized iron sheeting ; pigments.

The Iranian company would also like to receive offers from United Kingdom manufacturers of deep-drawing presses.

Suppliers interested in this enquiry should write direct to the Rialco Company Inc. If would be appreciated if, at the same time, they would notify the British Embassy, Economic and Commercial Department, Avenue Ferdowsi, Teheran, that they have done so.

Process Cuts Fumes Bogey

New I.C.I. system eliminates steam, spray*

MANY of the chemical treatments used in industry, although most efficient for the immediate purpose for which they are installed, prove very troublesome in other respects. The evolution of steam, spray and fumes from chemical processing baths can cause excessive loss of heat and chemicals, condensation problems, damage to nearby steelwork and unpleasant working conditions. The provision of reasonable working conditions can often only be achieved by the installation of an exhaust system which is sometimes costly and troublesome to maintain and operate. It was with these facts in mind that I.C.I. Paints Division decided to develop the ' Serseal ' Layer Process.

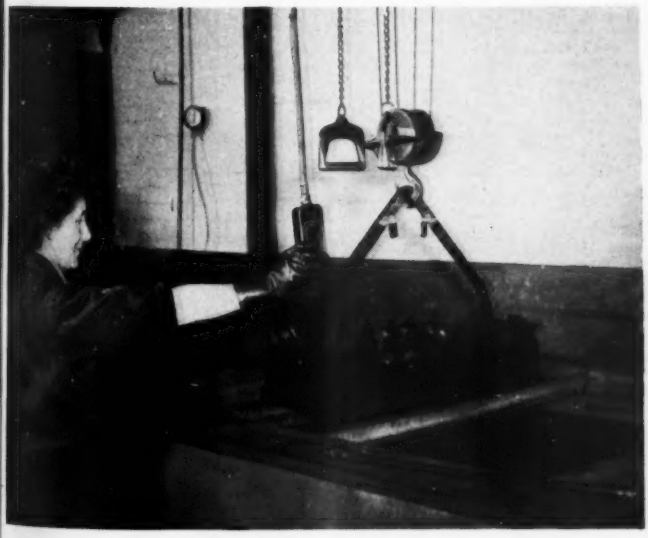
Extensive tests have shown that this completely eliminates the steam, fumes and spray, with all their undesirable consequences, by sealing off the surface of the chemical liquids in the processing tanks with an inert liquid layer. Various grades of ' Serseal ' have been formulated to suit the different operating temperatures and characteristics of phosphating solutions, acid pickling solutions and alkaline paint stripping baths.

The unpleasant effects of steam and fumes are often obvious in industrial plants and the most important benefit to be gained by their elimination is the improvement in working conditions. While this is difficult to express in terms of money, the cost of installing, maintaining and operating an exhaust system can be more easily assessed and will often be found to be exceedingly high. Similarly, the cost of paying for steam and fumes in the form of wasted fuel and chemicals is a major factor and the ability of ' Serseal ' to reduce heat and chemical losses has been confirmed by the many experiments conducted in the I.C.I. laboratories.

Industrial Tests

The first opportunity of testing the process on a production plant was at Folland Aircraft Ltd., Hamble, where two ' Granodine ' 101 plants were in use. Steam from the tanks created a nuisance and condensation attacked steel and aluminium aircraft components. The installation of an elaborate exhausting system was considered. A test of ' Serseal ' on the smaller of the two tanks was satisfactory and it was therefore decided to treat the larger tank, which had a surface area of 48 sq. ft. and which gave off most of the steam. The results were striking. Steam is no longer a problem, working conditions are vastly improved and there is no condensation. While no accurate estimate of the saving in gas consumption is possible because of the presence of other gas-fired equipment, the saving is estimated at about 75 per cent and smaller burners have had to be installed. The time taken to heat this tank from cold to 210°F is reduced from 10 to 2½ hours. The project for an exhaust system has been abandoned.

Below—In this tank, " Serseal " has eliminated a former steam nuisance



At the Royal Ordnance Factory, Poole, the exhaust equipment over the phosphating and rinse tanks were found to be in need of considerable repair. Application of ' Serseal ' to the tanks has eliminated steam completely with the result that the exhaust system can be dispensed with.

The Royal Ordnance Factory, Nottingham, provides another example of the value of the ' Serseal ' process. Alkali rinse and " Grandine ' 101 tanks, each holding 1,800 gallons and with a surface area of 72 sq. ft. have been treated. The result is once again the elimination of steam and it has been necessary to install smaller valves to reduce the heat input.

Lastly, at the works of Joseph Sankey and Sons Ltd., Wellington, ' Serseal ' was applied to an alkaline paint stripping bath. This bath formerly gave off unpleasant steam at 185°F. With ' Serseal ' there is no steam, even though the solution is nearly at boiling point and the paint stripping properties have been improved.

Method of Use

Simplicity of the process has much to commend it as no structural modification to the plant is necessary, although a simple trap fitted to the rinse tank overflow will recover any ' Serseal ' material dragged out on the processed work.

All that is required to bring the process into operation is to apply a measured quantity of ' Serseal ' Activator to modify the processing solution. Next, the ' Serseal ' is poured to float on the surface. So

(*Continued in page* 142)

**Condensed from I.C.I.'s " Pretreatment News " for March.*

CORROSION COURSES AT BATTERSEA

Subject for the fifth summer school to be held at the Battersea College of Technology during the week commencing July 14 this year is to be "Underground corrosion and cathodic protection."

Arranged in conjunction with the corrosion group of the Society of Chemical Industry, the school is intended primarily to advance the knowledge of chemists, metallurgists and engineers who are concerned with the corrosion and protection of underground pipes.

The application of cathodic protection to underground pipes willbe dealt with in some detail, but, in addition, other applications will be considered in the lectures.

Enquiries should be made to the Secretary (Summer School), at the College, London, S.W.11.

Sealing Process . . .

(*Continued from page* 141).

great is the heat conservation effect of 'Serseal' that the output of the heating unit must be reduced by at least 75 per cent before 'Serseal' is applied, as otherwise the liquid will boil over.

In its present form the 'Serseal' process cannot be used where contact with bitumen or rubber is likely to occur as these materials are softened. Also, for the time being, subsequent degreasing in trichloroethylene is recommended for work to be painted.

The main application for 'Serseal' in so far as its use on phosphating tanks is concerned is likely to be on the heavy phosphate coating baths, such as 'Granodine' 101, for the treatment of gears, piston rings and component parts which are usually given a final finish of oil or spirit stain.

Dollar Earner

Patent applications have been made to protect the 'Serseal' process and arrangements have been made to market this British invention in most countries. Already most satisfactory reports on the process have been received from licensed users in Canada and the United States.

Ideal Home Exhibition

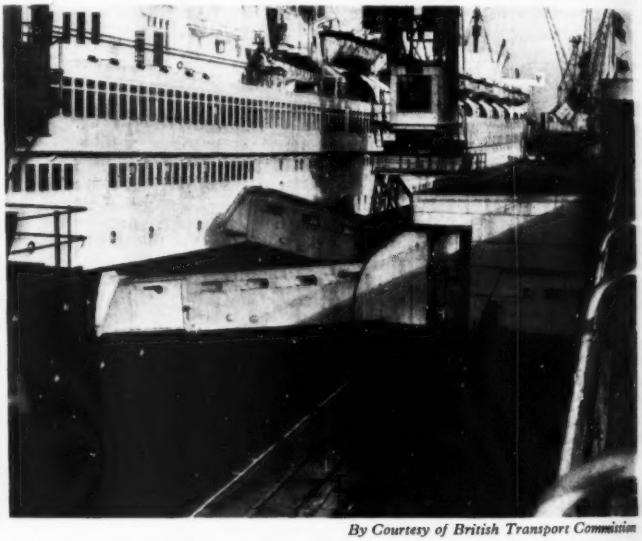
Brighter Colours Featured at Olympia

LIGHT metals play a very wide and varied part in the modern home, and this was demonstrated amply at the *Daily Mail* Ideal Home Exhibition held last month at Olympia.

Kitchen equipment comprised the bulk of exhibits made of these materials, and was shown by many of the firms taking part.

There were displays of fitted kitchen units, available as individual pieces so that the kitchen could be built up in stages, and ranges of kitchen sink units in a wide choice of colours, including models with stainless-steel or vitreous-enamel tops.

Also on show were stainless-steel or vitreous-enamel topped kitchen furniture and tables, stools, chairs and cabinets in an extensive range of cellulose enamelled finishes. And, of course, the newer entrants to the British home, the washing machines, refrigerators, etc., were to be seen in large numbers, adding an almost clinical sparkle to the show.



By Courtesy of British Transport Commission

GANGWAY RAMS GET SURFACE TREATMENT

SEEN in the picture above, the covered gangways used to embark and disembark passengers on the Cunarders "Queen Elizabeth" and "Queen Mary" lead into turrets mounted on rails so that they can be moved along the dockside. Lengths of the gangways can be varied by telescoping one section into another.

Originally installed in 1949, each gangway is fitted with two luffing and two slewing cylinders of the double-ended type, with piston rings fitted to the ram heads. During subsequent routine maintenance inspections, it was discovered that the exposed surfaces of the steel rams were becoming heavily pitted by the corrosive action of sea spray. So engineers of the British Transport Commission decided that the ram faces should first be renovated and then protected by being built up with a nickel deposition and given a surface finish of chromium. Fescol Ltd., North Road, London, N.7., carried out this work.

To prevent all the gangways being taken out of service at the same time, the 26 rams, including two spares, were treated in batches over a 4-year period from 1953-56. The "Fescolised" rams were returned to T. H. and J. Daniels Ltd., Stroud, Glos., original suppliers of the hydraulic equipment, who then rebuilt the cylinders and honed the bores.

The work was carried out under the supervision of Mr. J. H. Jellett, O.B.E., M.I.C.E., docks engineer of the B.T.C. Since re-installation, the rams have shown no trace of wear or corrosion, although some of them have been in use for nearly five years.

Nickel With A Difference

Combination of Ductility with Hardness

A NEW type of nickel deposit which is extremely hard yet flexible, Micrograin nickel, has been developed by Metachemical Processes Ltd. of Crawley, Sussex. The firm says that resistance to abrasion and impact of the metal are unusually high, better than those of softer types of nickel, nickel deposited from solutions containing organic addition agents, or stainless steel.

Electroforms on Blades

Electroforms of Micrograin nickel are being used on the leading edges of aircraft propellers, where they guard the delicate de-icer elements against rupture due to impact with hail, or stones during landing or take-off. Wings of aircraft or missiles can similarly be protected against abrasion, which becomes an ever more burdensome problem as speeds increase.

Tests conducted on a number of Viscount propeller blades show the advantages of protecting the de-icers with a Micrograin nickel electroform. While propeller tips were travelling at supersonic speed, batches of pebbles and rocks were sent down a chute, directed at the centre half of each propeller. Four different sizes of stones were used, each taking about 2 to 3 seconds to go through. Although the electroform was dented, the de-icer elements embedded in the rubber still functioned.

Nickel-Sulphate Bath

According to studies conducted by Mr. H. Denis Hughes and Mr. R. W. Lewis, the superior properties of the nickel electroform stem from the very fine grain size deposited electrolytically. Although a standard nickel sulphate bath at conventional *p*H and temperature is used — *without* organic addition agents — grain size is so minute that so far no method of etching the deposit for micrographic analysis has been found. The discoverers of the process have established that the fine grain is due to the characteristics of the electrically conductive plastic sheet on which the nickel is deposited.

Making the Electroform

To make a Micrograin nickel electroform, a master mandrel of metal is first prepared, cast to the exact contours of the propeller, wing, or other surface to be protected. An electrically conductive plastic coating, several mil thick, is then applied. After a flash coating of copper has been deposited, the unit is immersed in the nickel plating solution, and left until the desired thickness has built up. The propeller protectors have a naturally correct formation, i.e., with a heavier thickness (about 0.025 in.) at the leading edge, tapering off to 7 mil at the trailing edge.

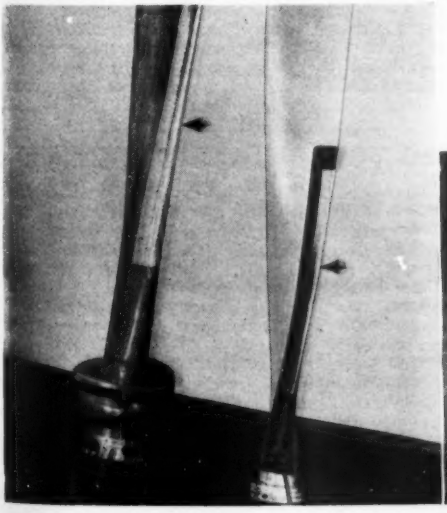
Under Compressive Stress

The finished electroform is under *compressive* stress, whereas most electrolytic nickel deposits show tensile stress. In fact, the compressive stresses set up are so noticeable that care must be taken during manufacture to prevent cutting the masking tape at the trailing edge, which would allow solution to enter between the mandrel and the plastic interlining, spoiling the piece.

Brinell hardness of the new type of nickel is up to 600, yet, as shown in the accompanying illustration it may be bent easily, without fear of cracking. Even shapes with re-entrant surfaces can be plated on the mandrel, removed, then closely fitted to the finished product. The 40-in. I.D. circular intake of a jet engine, tapering toward the inside, is one such application.

At the moment, principal applications are in the aircraft industry, though other applications are expected. Boat propellers, for example, can be protected against cavitational erosion. Car bumpers, instead of needing a laborious grinding, polishing, and sealing process prior to chrome-plating, can be left rough, and finished with a carefully, exactly-shaped electroform. One European car manufacturer is already doing this experimentally.

In all these uses, as in the case of propellers, the electroform is cemented into position with an epoxy adhesive.



Left.—Electroforms fitted to aircraft propellers to protect de-icing equipment emerge from plating bath with ideal shape. Below.—The electroform can be flexed easily by hand, does not work-harden.

VITREOUS ENAMELLED "BLACKBOARDS"

ARE the days of the old-fashioned blackboard numbered ? Schools all over the country may soon have enamelled metal chalkboards in their classrooms, replacing the traditional wooden boards.

Ferro Enamels Ltd., of Womboun, Wolverhampton, have recently produced a specially-formulated enamel applied to sheet iron bonded to plywood or similar backing material. Known as "Ferro" chalk-board, it is coloured a pleasant green, has a matt finish, and is claimed to be very restful to the eyes.

Being vitreous enamelled, the "board" is virtually indestructible. It has the great advantage of being easily cleaned and does not lose its surface or colour, as often happens with the conventional type of blackboard.

Supplied along with the chalkboards are tiny magnets to fix papers or information sheets to the board.

One of the boards has been installed at Wolverhampton Technical College recently, and education authorities are taking an interest in the development.

Institute of Vitreous Enamellers

THE Midland section of the Institute of Vitreous Enamellers held its annual dinner at the Station Hotel, Dudley recently. Mr. D. Sleath, the section secretary, very ably organized the event at which 65 people attended.

Following the loyal toast, proposed by Mr. L. Bayliss, section chairman (Ferramic Industries, Ltd.), Mr. W. E. C. Stuart, of Stuart and Sons Ltd., Stourbridge, and a prominent member of the Society of Glass Technology, proposed the toast to the Institute and Mr. Bayliss responded.

The subsequent proceedings were informal and members were entertained by Mr. Bastick on the piano. It was a "men only" party, the section having arranged for a ladies' night to be held later.

Tin Research Annual Report

Work on Bright Finish and Bearing Alloys

THE annual report of the Tin Research Institute issued recently indicates the progress being made in following up new ideas and developing fresh applications of tin. (Pubn. No. 275. Tin Research Institute Annual Report, 1957.)

A notable achievement was the publication of a method of producing electroplated deposits of tin in a fully bright form.

The tin deposit obtainable by electroplating has hitherto been matt and chalky in appearance and the new method produces coatings which come from the bath with the appearance of having been mechanically polished. The composition of the bath and the conditions for operating it have been published and the process is available without patent restrictions of any kind.

Other plating developments reported include the adoption of tin-nickel alloy electroplate by instrument makers when particularly hard-wearing and corrosion-resistant finishes are required.

The Institute's invention of a method of bonding aluminium-tin bearing alloys to steel has now reached the commercial stage of development and thousands of cars have already been fitted with the new type of bearings.

Tin as an impurity in cast iron has always been regarded as undesirable but recent work sponsored by the Institute at the Battelle Memorial Institute, U.S.A., shows that small amounts of tin may bring about desirable structural changes without detriment to the mechanical properties.

Organotin compounds have been investigated for a great variety of purposes during the year and a notable new use appears to be developing in agriculture. A leading chemical firm in Germany has marketed the first organotin fungicide for farmers' use. Research is going on at the Institute to find improved methods of analysis.

Corrosion studies at the Institute lately have been concerned with the nature and structure of oxide films on tin and tinplate ; both natural and artificially produced films are being investigated. The adhesion of lacquers to tinplate is also being studied.

The report surveys the activities of the Institute and its eight offices abroad and mentions a number of conferences and lectures, either organized by the Institute or in which members of the Institute took part.

An event of outstanding human interest in the report was the ceremonial opening of some tins of food salvaged from the Antarctic Expedition of Captain R. F. Scott in 1912 and opened by his son, Commander Peter Scott, last year, when the contents were over 46 years old.

The report of the Institute is available to libraries and other organizations free of charge.

MONOPOLIES ANNUAL REPORT

THE Board of Trade's annual report on the operation of the Monopolies and Restrictive Practices Act, 1948 and 1953, was published recently by H.M. Stationery Office. (Price 6d.)

The report includes a summary of the work and expenditure of the Monopolies Commission during 1957.

DISTRIBUTORS FOR FLOW INDICATORS

THE appointment has been announced recently of Sir W. H. Bailey and Co. Ltd., Patricroft, Manchester, as sole distributors for the flow indicating equipment produced by the Dukes and Briggs Engineering Co. At present, only the "Telicator" visual flow indicators are available, but other models are shortly going into full scale production to provide a range of flow indicators to cover all requirements.

The "Telicator" visual flow indicator is a simple, compact unit designed for high or low pressure systems that can be successfully used for extremely high or low rates of flow at any viscosity. Comparative flow can be gauged by the rate at which an easily seen rotor is revolving. The simplicity of the unit, together with its sprung jewelled bearings and strong metal external casing, ensures reliability, and cleaning is facilitated by the design of the cartridge.

Apart from the standard range for single or multicircuit indications, designs can be produced for individual requirements, and a special model is available for use with opaque liquids. Details can be obtained from Sir W. H. Bailey & Co. Ltd., Patricroft, Manchester.

GERMAN PLATING EXPERT VISITS BRITAIN

Visiting the Hemel Hempstead works of Roto-Finish recently to settle details for marketing a new bright plating in the U.K. was Mr. Joachim Skrodski (extreme left), export manager of Schering A.G. of Dusselford and Berlin. He is seen here with Roto-Finish representatives, l. t. r., Mr. E. W. Fondyga, plating specialist, Mr. J. C. Hendey, technical sales, Mr. R. B. Olliver, a director, and Mr. H. P. Evans, chief metallurgist.

NICKEL EXHIBITION IN BELFAST

DISPLAYS and working demonstrations are among the features of an exhibition being held by The Mond Nickel Co. Ltd. at the Grand Central Hotel, Belfast, from April 14-18. The exhibition is designed to show the latest uses and developments of nickel, nickel alloys and related materials, and is open between 10 a.m. and 7 p.m. each day.

Numerous displays have been planned to show corrosion resistance, surface protection, high magnetic permeability, weldability, controlled expansion, and mechanical properties at temperatures between 900°C and sub-zero. One particularly interesting demonstration shows how an alloy of platinum and rhodium can be used as a catalyst to re-ignite jet engines after a failure, and another exhibit is a red-hot nickel alloy rod carrying a load equivalent to seven tons per sq. in.

Part of the exhibition is devoted to spheroidal graphite cast iron.

Home-Made Tumbler Cuts Labour

A PAINT-TUMBLING machine has been designed by Mr. R. Anderson, M.I.Plant.E., to overcome a storage and operating problem and help to speed production. Mr. Anderson is chief engineer of E. Atkins Ltd., Alperton, Wembley, Middlesex, makers of "Add-to" unit furtniture for children.

The problem facing the firm was this: delivered in 5-gallon drums, the cellulose enamel used to finish the furniture becomes thick and unmanageable at the bottom of each drum.

The operators engaged in the paint spraying department spent 40 minutes each day stirring the cellulose until it was ready for use.

Mr. Anderson designed and made a paint-tumbling machine at a cost of about £300. Powered by a ½-h.p. electric motor, it has push-botton control.

Four 5-gallon drums of cellulose enamel and two 17 lb. cans of filler can be accommodated in holders on each side of a rotating spindle, and as the machine turns, the contents of each drum are tumbled and kept ready for instant use.

In storage the cellulose and filler are kept in a warm atmosphere to prevent thickening at low temperature.

MIDDLE EAST TRADE

IN a written answer to a question asked in the House of Commons recently, the President of the Board of Trade, The Rt. Hon. Sir David Eccles, K.C.V.O., M.P., announced the formation of an advisory council on Middle East trade.

He said that he has decided to make new arrangements to keep the Government in touch with representatives of industry and commerce who have practical experience of selling in the Middle East. The Minister of State will be chairman, and Mr. W. H. McFadzean of British Insulated Callender's Cables Ltd. has agreed to be vice-chairman and industrial leader of the council. Nine other business men have agreed to serve. Enquiries should be addressed to the secretariat of the council at the Board of Trade.

Supply Survey

REPLIES to a questionnaire sent out by the Institution of Chemical Engineers regarding the present and future supply of chemical engineers and the difficulties experienced in obtaining suitable teaching staff have been received recently.

These replies, when added together, are encouraging. By 1966, with adequate support, the country could provide 950 chemical engineers a year, as compared with just under 300 in 1956. This is better than the minimum goal for scientists and engineers as a whole given in "Scientific and Engineering Manpower in Great Britain" (H.M.S.O. 1956) but falls short of the estimates of some leading chemical engineers.

Stockpile Zinc

FOLLOWING on an announcement made last August, and subsequent announcements, the Board of Trade have been selling zinc from the stockpile at the rate of about 3,000 tons a month. They have now decided that in view of the state of the zinc market no further zinc will be offered for sale for the time being. An announcement will be made when it is decided to resume sales.

NEW COMPANIES

"Ltd" is understood, also "Private Co."
Figures = Capital, Names = Directors, all unless otherwise indicated.

Material Finishes, 205, Regent Street, London, W.1. February 19. £100. To carry on bus. of putting on a finish to all kinds of material and goods, etc. George W. Dawes, Emil W. Kotting, Hans. S. Feix-Martin and Victor W. P. Newman.

Corrosion Technical Services, 30 Craven Street, London, W.C.2. February 20. £1,000. To carry on bus. of dlrs. and mnfrs' agents, importers and exporters and mnfrs. of all types of anti-corrosive coatings, etc. Leslie M. Froude and Harry N. Inch.

Hambro Metal Polishing and Welding, 115, Wood End Lane, Northolt, Mddx. March 5. £100. Kenneth A. Brewer and Dorothy G. Brewer.

Alexander Socket Screws, Gunns Lane, W. Bromwich, Staffs. March 10. £10,000. To carry on bus. of mnfrs. of socket screws, grinding wheels, machine tools, etc. Geo. H. Alexander, Jas. W. Alexander and Geo. F. Alexander.

From the Register compiled by Jordan & Sons Ltd, 16, Chancery Lane, London, W.C.2.

More Nickel . . .

(*Continued from page* 139)

since the Korean War began in 1950. A still larger supply was in sight for 1958 and even more abundant supplies could be anticipated thereafter because of substantially increased free world nickel-producing capacity. As a consequence of these developments, the use of nickel by civilian industry can once again be governed exclusively by technical and economic considerations."

The turn-about in the supply-demand situation for nickel resulted from a number of factors. Free world nickel supplies during the year rose to approximately 490,000,000 pounds, an increase of 40,000,000 pounds over the previous high reached in 1956. Defence demands for nickel were substantially reduced, and much of the nickel under contract for delivery to the United States Government stockpile was released to industry. As a result, by the end of 1957 the supply of nickel was more than sufficient to meet the demand.

In the United States, the principal market, nickel deliveries exceeded total civilian and defence consumption by an estimated 50,000,000 lb. Unconsumed nickel remained in consumers' inventories, which rose to a record high ; and in accumulations in the hands of the United States Government, resulting from industry's inability to take nickel which had been offered by the Government to the trade instead of being stockpiled.

In Europe, the second largest market for nickel, demand for the metal during 1957 was, in general, in excess of supply, but by the year's end the gap had been virtually eliminated as a result of increased deliveries by producers, as well as releases from the strategic reserves of the United Kingdom Government for distribution in this country.

Manitoba project progresses

Full-scale development and construction work progressed during the year at the company's new nickel project in Manitoba, where it is opening underground mining operations and is building a mill, a smelter and a refinery, as well as a town for a population of 8,000.

As 1958 opened, stocks of nickel available to industry were accumulating, and the production capacity of the nickel producers was higher. As a result, more nickel than ever before will be available to industry in 1958.

MEETINGS OF THE MONTH

April 16

Society of Chemical Industry (Corrosion Group). Annual general meeting and spring lecture. "Corrosion research and its industrial background," by W. H. J. Vernon, at 14 Belgrave Square, London, S.W.1. 6.30 p.m.

April 17

Society for Analytical Chemistry (Midlands Section). "The analysis of silicones and related organo-silicon compounds," by R. L. Bass at the University, Edmund Street, Birmingham. 6.30 p.m.

April 18

Society of Chemical Industry (Fine Chemicals Group). "Organic peroxides and their industrial uses," by Dr. E. G. E. Hawkins, at 14 Belgrave Square, London, S.W.1. 6.30 p.m.

April 18

Oil and Colour Chemists' Association (Midlands Section). Annual General Meeting. Film Show. Regent House, St. Philip's Place, Birmingham. 6.30 p.m.

April 30

Institution of Chemical Engineers. 36th Annual Corporate Meeting and Dinner, at the Park Lane Hotel, Piccadilly, London, W.1.

ADDRESSES CHANGED

THE address of the new Midlands office of Wild-Barfield Electric Furnaces Ltd. is 71, Broad Street, Birmingham 15. Telephone : Midland 7232.

* * *

THE Manchester branch sales office of the British Aluminium Co. Ltd. has been transferred from its present address at 46, Fountain Street, Manchester 2, to Woolwich House, 59-61 Mosley Street, Manchester 2. Telephone : Central 2331. (Telegraphic address : Britalumin Manchester 2.)

* * *

FORMERLY of County Chambers, Corporation Street, Birmingham, Hermansen Furnaces Ltd., have moved to Eckersall Road, Kings Norton, Birmingham 30. (Telephone: Kings Norton 2284).

The company will continue to maintain its separate identity after having been taken over by Teisen Furnaces Ltd. recently.

* * *

ANOTHER recent move is by the Steel Co. of Wales, Ltd., from its former London address at Chesham House, Regent Street, to Margam House, 26 St. James's Square, London, S.W.1. Telephone : Trafalgar 4300.

AUTOMATION IN THE ELECTROPLATING INDUSTRY

A new film called "Automation in the Electro-Plating Industry," shows recently-installed plants for electro-plating and metal finishing in actual operation.

Fully-and semi- automatic installations for vat and barrel plating of all types and components are included.

The 16 mm film is silent and runs for about 40 minutes. It is available on loan, free of charge, from Silvercrown Ltd., 178, Goswell Road, London, E.C.1., makers of electroplating equipment and processes.

Latest Developments in PLANT, PROCESSES AND EQUIPMENT

Surface Finish Chart

A NEW "Profilometer" slide chart to provide a quick, accurate means of determining the right machining operation to use in getting a desired microinch finish, was announced recently by the Micrometrical Mfg. Co., 345, South Main Street, Ann Arbor, Michigan, U.S.A. Typical applications and tolerances are also given.

On the back of the chart is a compact set of operating instructions. By setting the arrow of the i.d. or o.d. to be measured, the chart will give the proper combination of "Profilometer" equipment to be used. The device is made of impregnated fibre board designed for hard use in the work shop. Its size is $3\frac{7}{8}$ in. x $7\frac{1}{4}$ in., attractively printed in red, green and black for easy reading.

Copies can be obtained on application to the Micrometrical Mfg. Co., who ask that a company letterhead be used for the purpose.

U.K. agents for this company are Gaston E. Marbaix Ltd., Devonshire House, Vicarage Crescent, London, S.W.11.

Dust-proof and Sealed Relays

THE English Electric Co., Relay Sales and Contracts Department, Stafford, is now manufacturing two new types of relay case, one dust-proof and the other completely sealed. Many relay faults can be traced to handling or to the presence of foreign particles and corrosion. The cases reduce the handling risk since regular maintenance periods can be considerably extended, and foreign particles are excluded by the sealing.

Dust-proof cases are for use in such installations as flour mills, cement works and steel works where dust can be 'breathed' into a normal relay case during changes in ambient temperature.

Completely sealed cases are essential under conditions of extreme heat, humidity and bacteria, or for factories in which a corrosive atmosphere exists. Sealing makes it possible for relays to be kept in service for up to approximately 10 years without maintenance.

Standard covers are still available for dust-free atmospheres.

For the dust-proof relay cases, breathing is effected through a filter that prevents the entry of fine dust but offers negligible resistance to air. The filter is fitted to the back of the case and contains a replaceable unit of shredded nylon to stop dust particles. Iron particles are trapped by a magnetized grating in the cap of the filter. In atmospheres in which iron particles are prevalent, they can easily be removed from the grating without having to replace the shredded nylon unit.

The completely sealed cases are plastic covered for protection against corrosive atmospheres, and contain a silica-gel indicator close to the inspection glass to give visual warning of a leak. The indicator has sufficient absorbent capacity to deal with the ingress of damp air when the cover is removed for testing the relay. The relay operation indicator can be hand reset by a push-button on the relay case, the operating rod that passes through the case being spring loaded and sealed with a gasket.

German Ultrasonic Cleaner

SPECIALISTS in developing and manufacturing ultrasonic equipment, Schoeller and Co., Frankfurt, Germany, have recently supplied automatic ultrasonic cleaning machines for cleaning assembled ball and roller bearing races.

The machines (Fig. 1) can clean 5,000 bearing assemblies of 30 mm. dia. per eight-hour shift, and can be set for cleaning bearing races in sizes

Fig. 1.—An ultrasonic cleaning cabinet, German-made and available in the U.K.

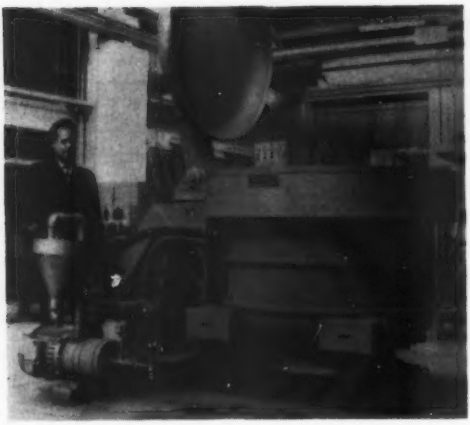


Fig. 2.—A large ultra-sonic plant, fully automatic, for cleaning fuel injection units and similar components.

from 25 mm. to 75 mm. in dia. Automatic machines can also be supplied for other sizes.

Using two ultrasonic cleaning stages, the machines employ a device for revolving the bearing races during the cleaning operation. The cleaning fluid used is petroleum ; filtering apparatus and a circulation pump are built-in.

Agents in the U.K. for the equipment are Roto-Finish Ltd., Mark Road, Hemel Hempstead, Herts.

Metal Cleaning by Ultra-sonics

THE use of high-frequency sound waves for industrial purposes is a relatively recent development. In the past few years there has been a very rapid growth of a new industry to develop the practical use of mechanical vibrations at frequencies above the audible range for cleaning, homogenization and sterilization, pigment dispersion and also for acceleration of fermentation of alcohols. The term " ultra-sonics " is usually applied to the frequencies used in these applications (Fig 2).

An important application of ultra-sonics to metal cleaning is now available combined with a vacuum technique from Electro-Chemical Engineering Co. Ltd., Woking, Surrey. Developed by Technochemie of Switzerland, EFCO ultra-sonics has already proved itself with nearly 100 production installations in Europe and America. Most of the installations in Europe are used by the Swiss watch industry, and can deal with high production requirements and the cleaning of a considerable mass. The frequencies used are 400 K/cs. and 40 K/cs., and the transducers are piezo-electric made of barium titanate. Frequencies lower than these can in some cases cause damage to fragile parts by vibrations, and could, if low enough, cause damage through erosion.

The advantages of the vacuum technique are considerable. With the removal of air from the solvent, cavitation is far more effective, air pockets are removed from any intricate component, thereby enabling the entire surface to have good solvent-surface contact, essential for good cleaning. Impacted compound in small blind holes is also easily and readily removed with the use of this technique.

This is the cleaning sequence usually followed : (1) A pre-cleaning operation with perchlorethylene or trichlorethylene with continuous filtration. (2) An ultra-sonic stage with or without vacuum, but with continuous filtration using the same solvent. (3) A continuously filtered rinse also using the same solvent. (4) A vapour degrease process and (5) A drying stage which may include the use of vibration, infra red and a stream of hot filtered air. All these processes may be incorporated in hand or fully automatic machines.

An Industrial Cleaner to Pick Up Liquids and Dirt

A NEW industrial vacuum cleaner which will pick up liquids as well as dust and dirt, has been introduced by the electrical equipment division of Martindale Electric Co. Ltd., Westmorland Road, London, N.W.9. Known as the Martinet wet-dry suction pick-up, the cleaner is suitable for a variety of purposes in metalworking shops such as picking up dirt, oil and grease from floors and machinery and assembly lines. Metal chips from machine shop floors can also be picked up and salvaged.

The Martinet consists of any standard Martindale portable blower mounted on a rust-proof four gallon tank, on wheels, with filterbag, hose and suction tool attachments.

The lid of the tank is made of cast aluminium and incorporates a centrifugal device to ensure that while liquids and heavy dust particles are sucked into the tank, only fine dust is passed through to a filter bag attached to the blower unit. A shut-off device closes the suction inlet when four gallons of liquid have been picked up. The lid is clamped to the tank with quick-release toggle clips.

The Martinet can be used for picking up soapy water, detergents, grease and oils from any type of flooring, using a 12-in. squeegee floor tool and a special hose available for the purpose.

For collecting dust any Martindale suction tool can be fitted to the standard 6-ft. rigid tube connected by a hose to the wet-dry cleaner.

The Martinet is fitted with three solid-tyred metal wheels. It will work off a.c. or d.c. in two main voltage ranges — 100/130 volts and 200/250 volts.

Fig. 3.—A waste products regenerator.

Reclamation of Waste Products

ALREADY well known on the Continent, the Schlegel system for refining used oil is being marketed in this country by Liquid Systems Ltd., Norwich Union House, Wellesley Road, Croydon, Surrey.

The Schlegel regenerators (Fig. 3) are made by a Stutgart firm of that name, and combine distillation, adsorption and filtration processes, working on a physical-chemical principle. The regenerators can be used for petrol, turpentine, kerosene, nitro-solvents, trichlorethylene, etc.

After the initial preparation of adding a refining agent and pressurizing the regenerator with either a hand pump or a compressor to 35 lb. per sq. in., the process is entirely automatic.

The air-pressure switches on an electric heating system and this, together with the agent, initiates a soft refining process to separate any oxidizing products dissolved in the waste oil. Simultaneously, grit and other foreign particles are completely removed, and slight pollutions are evaporated.

The makers claim that the regenerated oil has the characteristics of new oil. It flows from the machine in an even stream, and when the charge has been completely processed, the heating is switched off automatically. A dry, compressed cake, easily removed by a scraper, comprises the residue remaining in the machine after the process has been completed.

Illustrated in Fig. 4 is the M.A. model in the range. It has a capacity of 9.9 gals. A smaller model (the K.A.) has a third of this capacity, and larger models are available up to 88 galls. Models K.A. and M.A. have processing periods of 1 to 5 hr. for a single charge, depending upon the degree of pollution, and will produce up to 95 per cent. of the original charge as regenerated oil, depending upon the amount of dirt present.

Pump for Transferring Paint

EARLY last year Alfred Bullows and Sons, Ltd., Long Street, Walsall, Staffs., introduced to this country a pump widely used in the U.S.A. They are now manufacturing it under licence from The Binks Manufacturing Co. of Chicago.

It enables paint to be used straight from a bulk container as delivered by the paint supplier. This in turn makes possible the installation of a small- or medium-sized circulating system at much lower cost than hitherto, and it is now possible to install a simple circulating system feeding up to six operators for a comparitively modest sum.

Common practice in many workshops to-day is to buy finishing materials in bulk containers and to transfer the material to other containers for use in the shop. Many paint manufacturers are now prepared to supply their paints at controlled viscosity ready for use. The pump illustrated in Fig. 4 has been designed to enable paint to be used straight from the drum.

Designated the 52/61 Bullows-Binks "Pogo" material handling pump, it can supply paint to a gun or guns straight from the container to a dead-end system for non-pigmented materials or to a circulating system where the materials to be handled may settle out in the lines. It will provide a steady flow of material to be delivered at a high rate with a long, smooth pump stroke, giving delivery on both the up and down stroke. The makers say that low maintenance cost and long life are assured by very low operating speeds.

Depending on the application, the unit is suitable for supplying material to at least six spray guns over a medium-size circulating system, providing that pipe sizes are adequate. Again depending upon the type of material in use it has a delivery pressure up to 200 lb. per sq. in., for a main line air pressure of 70 lb. per sq. in. Air consumption is 3 - 6 cu. ft. per min. and the pump has a maximum capacity of 1 gal. per min.

Fig. 4.—A pump enabling paint to be transferred direct from the drum.

Overseas Review

(*Continued from page* 122)

Phosphating

Spray techniques which combine mechanical and chemical action are finding increasing applications in the Russian car, tractor and farm machinery factories for conveyorized cleaning, pickling and phosphating. These processes have been investigated on a semi-industrial scale at one of the top U.S.S.R. research institutes and the published summary of their findings makes extremely interesting reading[6]. Although their conclusions reveal little new regarding cleaning and pickling, eyebrows might be raised if one attempted to introduce their spray phosphating system into British or American factories. The processing solution is a nitrate-nitrite-hypochlorite accelerated zinc phosphate mixture operated at the high strength of 58-60 Points and a temperature of 25-30°C. but requiring a spray processing time of 3-5 minutes.

Also working with a phosphate treatment which operates at room temperature, Knanishu[7] has shown that whereas a minimum immersion time of 20 minutes was required to produce coatings on grit blasted steel which when given one coat of enamel MIL-E-10687 withstood 144 hours salt spray test, 30 minutes processing was required when no preliminary grit blasting was employed. This beneficial effect of grit-sand-or shot-blasting before phosphating has, of course, been known for years in the trade.

References

(1) *Products Finishing*, 1958, **22**, (6), 24-35.
(2) *Metal Finishing*, 1958, **56**, (1), 53, 54, 57.
(3) *Steel*, 1958, Feb. 3, **142**, (5), 112-113.
(4) *Product Finishing*, 1958, **22**, (4), 54-57.
(5) *Light Metal Age*, 1957, **15**, (11/12), 10-14.
(6) *Metal Finishing*, 1958, **56**, (3), 48-51.
(7) *ibid.* 57-62.

Classified Advertisements

Prepaid rates: FIFTEEN WORDS for 7s. 6d. (minimum charge) and 4d per word thereafter, or 24s. per inch. Box number 2s. 6d., including postage of replies.

SITUATIONS VACANT

VITREOUS ENAMELLING : A SALESMAN familiar with this trade is required to represent company anxious to expand its jobbing trade. The position is full of scope for the right man, who may rely upon good remuneration, excellent technical support, and competitive quotations. Box 102, METAL FINISHING JOURNAL.

METAL FINISHING-ENGINEERING MANAGER required for two factories. Must have a bent for simplicity and efficiency. Dohm Ltd., 167, Victoria St., London, S.W.1.

SITUATION VACANT—contd.

PLATING RESEARCH

Young man or woman required to fill a vacancy arising as the result of the expansion of the section of the Research Laboratory of the Mond Nickel Company Limited at Birmingham, which undertakes research concerned with electrolytic and other methods of plating. The work covers a wide field of both fundamental and practical investigations. Publication of the results of research is encouraged. Experience in this field is not essential, but a good honours degree in Science is desirable.
Salary will be in accordance with experience and qualifications. Pension and assurance schemes are in operation and, in appropriate cases, assistance can be given for housing. Applications, which will be treated in confidence, should give details of age, qualifications and experience, and be addressed to The Manager, Development and Research Department, The Mond Nickel Company, Limited, Thames House, Millbank, London, S.W.1. Please mark envelope "Confidential L.55."

REPRESENTATIVE REQUIRED by London Plati Supply House for Midlands. Car required. App Box No. 101 METAL FINISHING JOURNAL.

MACHINERY FOR SALE

PLATING AND ANODISING M.G. SETS

250 amp., 5 volt G.E.C.
500 amp., 6 volt Canning.
240 amp., 60 volt E.C.C.
500 amp., 24 volt L.S.E.
600 amp., 30 volt Mather & Platt.
750 amp., 60 volt Mather & Platt.
500 amp., 60 volt Crom. Park.
750 amp., 20 volt. Canning.
1,250 amp., 55 volt G.E.C.
1,500 amp., 10 volt Canning.
1,600 amp., 12 volt Mather & Platt.
2,000 amp., 4.5 volt Morley.
2,000 amp., 6.5 volt Morley.
1,250 amp., 60 volt G.E.C.

RECTIFIERS
500 amp., 6 volt Canning.
1,000 amp., 8 volt Canning.

BRITANNIA MANUFACTURING CO., LTD.,
Britannia Walk, London, N.1
Clerkenwell 5512/4.

NEW JOHANNSEN SHEET METAL GRINDING & POLISHING MACHINES for sale. Motor driven 400/440/3/50. Single and double belt models in four sizes to take all kinds of sheet metal up to 9′ 11″ x 4′ 11″. Full details and illustration from F. J. Edwards Limited, 359, Euston Road, London, N.W.1. Euston 4681, or 41, Water Street, Birmingham 3, Central 7606.